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Covering the Literature on Atomic Energy
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NP-3069	The Chemical Determination of Thorium in Its Ores. John C. Ingles.	4117
NP-3072	Cytological Analysis of Translocations in Corn Chromosomes Resulting from Ionizing Radiation of the Test Able Atomic Bomb and X-rays and of Translocations from Other Sources. A. E. Longley.	4061
NP-3079	Amplitude Modulation of Synchronized Microwave Oscillators. (Technical Report No. 166) W. P. Schneider and E. E. David, Jr.	4174
NP-3080	Correlator Errors Due to Finite Observation Intervals. (Technical Report No. 191) Wilbur B. Davenport, Jr.	4175
NP-3081	Signal-to-Noise Ratio in Correlation Detectors. (Technical Report No. 186) R. M. Fano.	4182
NP-3083	Research and Training Facilities for Radiobiology and for Use of Isotopes in Biology and Medicine in The United States and Canada. D. Harold Copp.	4053
NP-3089	On a General Method of Solving Second Order Differential Equations by Phase-Plane-Displacements. (Technical Report No. 13) Lydik S. Jacobsen.	4193
NP-3090	Transverse Vibration of One- and of Two-Span Beams Under the Action of a Moving Combined Load Consisting of a Spring-Borne Mass and an Alternating Force. (Technical Report No. 12) Vibration Research Lab., Stanford Univ.	4151
NP-3093	Further Experiments on the Kingdon Cage. (Technical Report No. 4) Nathan Wainfan and G. L. Weissler.	4176
NP-3094	Radiac Instruments Laboratory Manual. Chemical Corps School, Army Chemical Center.	4209
NP-3096	Correction Tables for Radioactive Decay. Barbara S. Smith.	4278

Report	Title, Author	Abstract
NP-3099	Assay of Uranium-Bearing Ores by Fission Analysis. (Topical Report No. TR-60/51) W. W. Happ and J. L. Horwood.	4142
NRL-trans-317	Electron Emission from Thin Films of Dielectric under the Influence of Bombardment of Positive Ions, trans. from Zhur. Eksptl'. i Teoret. Fiz. 19, No. 4, 297-9(1949). S. V. Starodubtsev.	4147

GENERAL

RESEARCH PROGRAMS

4053

National Research Council, Committee on Nuclear Science
RESEARCH AND TRAINING FACILITIES FOR RADIOBIOLOGY AND FOR USE OF ISOTOPES IN BIOLOGY AND MEDICINE IN THE UNITED STATES AND CANADA. D. Harold Copp. June 1950. 156p. (NP-3083)

Under the auspices of the Subcommittee on Radiobiology and the Committee on Nuclear Science of the National Research Council, a survey of available research and training facilities for radiobiology, medicine and the use of isotopic tracers in biological research was undertaken throughout the United States and Canada. Seventy institutions in 41 cities were visited and additional reports from 60 institutions were obtained. For each institution are given: research activities in the field, clinical use of isotopes, training in their use, work proposed for the future, health-protection procedures, number of staff members, and students engaged.

BIOLOGY AND MEDICINE

4054

Brookhaven National Lab.
BIOLOGY DEPARTMENT, p.115-24 of QUARTERLY PROGRESS REPORT; OCTOBER 1–DECEMBER 31, 1950. Mar. 1951. 10p. (BNL-93(p.115-24))

Brief status reports are presented on studies of the relation between chromosome breakage and mitotic inhibition, regeneration of γ-irradiated Tradescantia, cytochemical analysis of x-ray effects, effects of x rays on fibrinogen, adrenal cortical requirements of adrenalectomized x-irradiated rats, effect of glucose injection on the radiation syndrome, water metabolism following x irradiation, the role of the adrenal in the irradiation syndrome, sucrose storage in corn plants, effect of generation time on mutation rate in bacteria, effect of substrate on the endogenous respiration of a mold, effect of dinitrophenol on phosphate metabolism, disappearance from mouse tissue of carbon from assimilated sucrose, and exchange between plasma iron and red cells.

4055

Atomic Energy Project, Univ. of California, Los Angeles
THE RELATIONSHIP OF FAT AND VITAMIN A ABSORPTION IN THE MOUSE INTESTINE. James F. Mead, Arthur B. Decker, and Leslie R. Bennett. May 14, 1951. 10p. (UCLA-136)

Methyl oleate containing 10% methyl octadecadienoate (known to be an accurate tracer for absorption of methyl-oleate) and 5% vitamin A acetate were fed to mice. It was found that the rate of absorption of methyl oleate in the mouse is greater than that of vitamin A when the two are fed simultaneously. The difference is even greater in fasted animals. A possible explanation would be Frazer's theory of an alternate pathway of fat absorption after hydrolysis through the lymphatics and the portal vein.

4056

PLASMA PROTEIN–BOUND IODINE DETERMINATIONS. William N. Harsha. Am. J. Med. Sci. 221, 626-7(1951) June.

A technique utilizing liberated iodine as a catalyst in the oxidation-reduction reaction of a ceric-arsenite system (Barker, J. Biol. Chem. 163, 313(1946)) is described and recommended for determining circulating plasma protein-bound iodine. The method is highly accurate yet simple enough to be used as a routine clinical laboratory procedure. Of the 60 patients studied, normal persons had plasma protein–bound iodine levels varying from 3 to 10 μg/100

cc; thyrotoxic patients had levels from 12 to 46 μg/100 cc; while myxedematous patients had levels from 0.2 to 3 μg/100 cc. (auth)

RADIATION EFFECTS

4057

Atomic Energy Project, Univ. of California, Los Angeles
THE EFFECT OF ROENTGEN RAY IRRADIATION ON RATS PREMEDICATED WITH THYROXIN AND THIOURACIL DERIVATIVES. Thomas J. Haley, Samuel Mann, and Andrew N. Dowdy. May 18, 1951. 11p. (UCLA-135)

Hypothyroidism, induced by feeding nontoxic doses of thiouracil and its derivatives, does not significantly increase survival time or decrease the total mortality of roentgen-ray-irradiated rats. Propyl thiouracil significantly increased the rate of and total mortality of roentgen-ray-irradiated rats. Hyperthyroidism produced by the subcutaneous injection of thyroxine into rats increased the rate and, in one experiment, the total mortality of roentgen-ray-irradiated rats. It was concluded that the potential sulfhydryl group in the thiouracil compounds' molecules is available for protecting the sulfhydryl groups in the animal organism, but a great excess must be present before any protectant effect can be observed. In such cases these drugs would be exerting pharmacological rather than antimetabolic effects. (auth)

4058

Atomic Energy Project, Univ. of Rochester
CROSS CIRCULATION STUDIES ON THE IRRADIATED DOG. P. Rekers, P. Salisbury, J. Miller, N. Marti, and N. Papageorge's, Jr. Mar. 30, 1950. 12p. (UR-159)

Cross-circulation studies between dogs that had received a single x-radiation dose of 450 K, LD_{95}, 6 to 10 days previously and normal dogs have been carried out by use of direct carotid to carotid artery anastomosis and a cross-transfusion apparatus. With each technique elevation of the leukocyte and erythrocyte levels was noted during the period of cross circulation. At the termination of the carotid type of cross circulation, there was a drop in the leukocyte count to pre-circulation levels within 20 hr, while with the cross-transfusion apparatus the leukocyte count continued to rise for 8 hr or more after cross circulation and returned to the marked leukopenic level 48 hr after the termination of the cross-circulation procedure. Data on thrombocyte deflections are not sufficiently definite.

4059

Atomic Energy Project, Univ. of Rochester
EFFECT OF SINGLE DOSES OF X-RAY ON THE SURVIVAL OF RATS. T. Noonan, F. Van Slyke, and J. Hursh. Apr. 20, 1951. 12p. (UR-161)

Parallel groups of male and female 5-month-old Wistar albino rats were used. Three groups, each of 24 rats, received respectively 150, 300, and 600 r in single doses of 250-kvp x irradiation, delivered at 18.5 r/min. Twenty-four male and 24 female rats served as controls. The mean survival times appear to be reduced by an amount proportional to the dose in both the male and female series. The spread of the data does not permit the exclusion of a possible threshold effect on survival as tested for the 150-r groups vs. the controls. Tumors which were grossly visible occurred in a larger number of 150- and 300-r female rats than in the control group.

4060

Yale Univ.
PROGRESS REPORT FOR AUGUST 1, 1949–MARCH 1, 1950. Ernest C. Pollard. Mar. 15, 1950. 66p. (YUP-2)

Deuteron bombardment as a method of molecular-weight measurement has been established. The method has been applied to pepsin, trypsin, invertase, hemoglobin, T-1 bacteriophage, and monolayer bovine serum albumin. Preliminary action spectra of T-1 bacteriophage and of influenza virus (as assayed by both infectivity and agglutination) have been measured. Deuteron plus x-ray bombardment as an estimate of number of genetic elements has been tried in the cases of B. subtilis and T-1 phage. Thermal-inactivation studies, both wet and dry, of the bacteriophages T-1, T-3, and T-7 have been made. (auth)

4061

Naval Medical Research Section, Joint Task Force One
CYTOLOGICAL ANALYSIS OF TRANSLOCATIONS IN CORN CHROMOSOMES RESULTING FROM IONIZING RADIATION OF THE TEST ABLE ATOMIC BOMB AND X-RAYS AND OF TRANSLOCATIONS FROM OTHER SOURCES. A. E. Longley. June 10, 1950. 60p. (NP-3072)

Of the 588 chromosome translocations in corn described, 220 came from various sources, 179 from seeds treated with measured dosages of x rays, and 172 from seeds exposed to ionizing radiations of the Test Able bomb. The nonrandom distribution of the Bikini-induced translocations was different from that of the x-ray-treated controls. Chromosome arms staining heavily adjacent to the fiber attachment had more breaks than expected when treated with x rays and fewer breaks than expected when exposed to the Bikini radiation. Chromosome arms staining lightly throughout their length had fewer breaks than expected when treated with x rays and more than expected when exposed to Bikini radiations. A comparison of the position of breaks resulting from low, medium, and high dosages of x rays indicates that the proportion of breaks in heavily staining areas is greatest when the dosage is highest, and in lightly staining areas is greatest after low dosages. The position of the breaks in Bikini-treated material indicates that the dosage intensity was intermediate between the low and medium x-ray dosages studied. Among the whole population of translocations there was a tendency for breaks the same distance from the fiber attachment to be associated more frequently than expected on a random basis.

RADIATION HAZARDS AND PROTECTION

4062

Kellex Corp.
PROGRESS REPORT; FIRST QUARTER, 1951; DEVELOPMENT OF LABORATORY DISPOSAL UNIT. Apr. 16, 1951. 19p. (KLX-1340)

Laboratory column tests using tap water contaminated with radioactive material and also containing colloidal matter are described. It is shown that higher column efficiency resulted when the tap water was filtered free of the colloidal matter. The decontamination of solutions of single salts containing radioactive Ba, Fe, Ni, Ru, S, and Cl has been investigated. Citric acid added to these solutions as a complexing agent increased the adsorption of iron and nickel by the ion-exchange resin. Additional performance data on the decontamination of solutions of individual fission products are presented. Comparative performance data on three commercially available laboratory-scale demineralizing units have been obtained using feeds of individual and mixed fission products. Of the units tested the one with greatest resin bed depth gave the best performance in terms of gallons decontaminated per cu ft of resin. Results of an accelerated decontamination test to compare the efficiency of the disposable ion-exchange cartridge of the prototype unit with that of a laboratory column are presented graphically. Certain results, contrary to what would ordinarily be expected, on the effects of resin particle size on volume decontaminated are listed. A laboratory radioactive-waste disposal unit is illustrated.

4063

Oklahoma Univ. Research Inst.
STUDIES IN ISOLATION AND IDENTIFICATION OF FLAVONOID PIGMENTS OF USE IN THE CONTROL OF RADIATION INJURY; PROGRESS REPORT FOR 1950. Dec. 29, 1950. 17p. (ORO-32)

Through the use of ion-exchange resins (Amberlite IRC-50), a new and relatively simple isolation of pure morin, from Morus tinctoria, has been achieved; also an improved method for obtaining homoeriodictyol. Other isolation methods reported here produced apigenin from parsley, galangin and kaempferide from galanga root, dihydroquercetin from Douglas fir bark, flavonoids from lemon flavin, flavonoid glycoside from the locust (Gleditsia triacanthos), and flavonoid pigments from fruit of sycamore tree, okra, and prunes. Chemical transformations being studied are: flavanones to flavones; hesperidin and hesperetin to diosmin and diosmetin, and naringin to apigenin-7-rhamnoglucoside and apigenin; demethylation of flavonoids to eriodictyol; and hydrolysis of glycosides to produce rhamnetin and naringenin. Eriodictyol-7-rhamnoglucoside, crude apiin and xanthorhamnin are also available. A convenient form of laboratory wet grinder and extractor is described, which was constructed by effecting a few simple alterations on a commercial garbage disposal unit for use on fresh and dried plants, and on animals.

4064

Naval Radiological Defense Lab.
RELATIVE IMPORTANCE OF EXTERNAL AND INTERNAL RADIATION HAZARDS FROM AN ATOMIC BOMB DETONATION. A. L. Baietti and F. R. Holden. Nov. 8, 1950. 13p. (AD-268(H))

External- and internal-radiation hazards are known to exist simultaneously after a contaminating-type atomic bomb detonation. Theoretical postulates (based on empirical data) show that for initial tactical and salvage operations occurring the first 24 hr after an atomic bomb detonation, external radiation is of greater tactical importance. As radioactive decay comes into play and localized high-radiation areas are bounded and probably somewhat decontaminated, emphasis shifts to internal hazards. These internal hazards can persist for long periods since only small concentrations are required to produce devastating internal effects in man. (auth)

RADIOTHERAPY

4065

[METHODS OF CALIBRATION OF RADIUM β-RAY DOSAGE]; delivered at the International Congress of Radiologists in Stockholm, July 1928. July 1928. 87p. (NP-2181)

The following papers presented at the Congress have been translated from the German.

A Micro-Ionization Chamber for Roentgen and Radium Rays. E. Stahel. A liquid chamber using hexane or petroleum ether and permitting the measurement of the radiation distribution in the immediate vicinity of the Ra preparation is described, and the results of tests are discussed. It is shown how isodose curves may be determined for any combination of sources.

The Determination of Energy Quantities Absorbed by the Tissue in the Treatment with Gamma and Roentgen Rays. E. Stahel. Description of a calorimeter which permits the measuring of the energy absorbed per volume unit with Ra irradiation of a fluid; practical application of the calorimeter for local and long-range Ra treatment; translation of the D-dose unit for γ rays into erg/cm^3; 1 D = 38,000 erg/cm^3; computation of the erythema dose for γ rays in absolute units, 1 HED (skin erythema dose) = 18 D = 700,000 erg/cm^3; proof that for local Ra treatment far larger energy quantities may be given than for long-range Ra treatment (up to 8,000,000 erg/cm^3); description of a calorimeter for roentgen rays; and a determination of the HED for roentgen rays in absolute units (1 HED = 600 r and corresponds to approximately 96,000 erg/cm^3) are presented. It is concluded that with the same amount of energy absorbed the roentgen rays are biologically several times more effective than γ rays.

The Absolute Determination of the Dose Unit "1 Roentgen." Hermann Behnken. The causes of the discrepancies between the "roentgen" and the electrostatic dose unit remain unexplained for the time being. The measurements which are of interest in this connection are described in detail, and their accuracy is discussed.

Measurements with Soft Roentgen Rays. (Chaoul Technique). W. V. Mayneord. Measurements with roentgen rays of 60 kv with small-focus skin distance (3 and 5 cm) are reported. A new-type dosimeter employed for these examinations is described. Tests relative to reflection dispersion, to percentage depth dose, and to over-all distribution are described. The results of measuring the stray radiation are set forth. Theoretical possibilities for a mathematical discussion of the dose distribution problem are indicated.

TOXICOLOGY STUDIES

4066

Cincinnati Univ.
PERSISTENCE OF BERYLLIUM OXIDE IN LUNGS AFTER

INHALATION OF DUST. Frank R. Dutra, Edward J. Largent, Jacob Cholak, Donald M. Hubbard, and James L. Roth. [nd] 17p. (AECU-1316)

Experiments were devised to give information as to the rate of accumulation of Be_2O_3 dust in lungs of rats breathing an atmosphere containing such dust and the rate of elimination of Be_2O_3 after terminated exposure. Significant amounts accumulated in short periods of time; progressive accumulation occurred after intermittent respiratory exposure, little tendency for elimination or redistribution of Be from the lungs to other tissues had shown a year after the last period of exposure. Response of pulmonary tissues of rats to Be is minimal and cannot be compared to pulmonary berylliosis in man.

TRACER APPLICATIONS

4067

Washington Univ., St. Louis School of Medicine
FATE OF I^{131} LABELLED BOVINE GAMMA GLOBULIN IN RABBITS. F. J. Dixon, S. C. Bukantz, G. J. Dammin, and D. W. Talmage. [nd] 9p. (AECU-1303)

Following injection of I^{131} labeled antigen, the radioactivity in the body can be separated into protein-bound (residual antigen) and nonprotein-bound (in blood and tissues) fractions, plus that excreted in urine. Catabolism of I^{131}-protein antigens liberates nonprotein-bound I^{131}, and the liberated I^{131} is rapidly eliminated primarily in the urine. I^{131}-antigen injection, therefore, provides a technique for quantitative measure of antigen concentration and rate of antigen catabolism. After equilibration between vascular and extravascular components was established following intravenous injection of I^{131} rabbit globulin into the rabbit, the labeled globulin disappeared at a constant rate with a half life of about 2 days representing the rate of catabolism of homologous globulin. Tracing of I^{131}-labeled bovine gamma globulin in rabbits indicates that the antigen is handled much like the animal's own globulin until antibodies to it are formed. With the appearance of antibody, the antigen is rapidly removed from blood and extravascular fluids, probably by phagocytic cells and is rapidly catabolized. There does not appear to be any cellular enzymatic adaptation necessary in the sensitized, rapid catabolism of antigen. Antibody production, although initiated in the presence of antigen, is carried on long after all antigen has disappeared.

4068

Cancer Research Inst., New England Deaconess Hospital, and Laboratory of Pathology, Harvard Cancer Commission
P^{32} LOCALIZATION IN THE INTESTINE. Margaret W. Holt and Shields Warren. [nd] 5p. (AECU-1337)

Radioautographic and histochemical observations of frozen-dried rat and mouse intestine containing P^{32} are described. A typical localization pattern is present in the intestine at 0.5, 2, 4, 8, 24, and 48 hr following P^{32} administration; the radioautograph pattern corresponds exactly with the pattern of localization of desoxyribose nucleic acid in stained sections. Localization of P^{32} in other chemical form (inorganic?) probably occurs previous to or associated with nucleic acid synthesis. Administration of P^{32} because of its high local concentration might be considered as a potential radiation hazard. 5 figures.

4069

Sloan-Kettering Inst. for Cancer Research
THE ZONE OF LOCALIZATION OF ANTIBODIES; XII. IMMUNOLOGICAL SPECIFICITIES AND CROSS REACTIONS IN THE VASCULAR BEDS OF LIVER, KIDNEY, AND LUNG. David Pressman and Beila Sherman. [nd] 23p. (AECU-1341)

The iodinated antibodies from anti-rat-kidney serum which localized in the kidneys, liver, and lungs of donor rats were purified in vivo by elution with NaOH from insoluble sediments obtained from the homogenates of the tissues of the donor rats; of 42×10^6 cpm radioactivity injected with (I^{131}) radioiodinated globulin-fractions of rat-kidney antibody, total radioactivity recovered by purification was 1.6×10^5 cpm in liver, 3.5×10^4 in kidney, 7.2×10^3 in lung; tissue-eluates obtained from the I^{131} antiovalbumin sera contained slightly less radioactivity. These purified antibody preparations were tested for localization properties by injection into recipient rats. It was found that the purified radioantibodies from all 3 tissues localized to some extent in the kidney, but the antibody isolated from each organ also showed some preference for localization in the organ of initial localization. Observations made with tissue eluates from radioiodinated globulin fractions of rat-lung antibodies were similar. From the very rapid rates of localization of the antibodies it has appeared that the localization must take place in the vascular bed of the organ. If certain perivascular diseases such as glomerulonephritis and multiple sclerosis are caused by a process of autoimmunization, it is probably the localizing antibody which is the damaging agent, and the organ which is attacked is determined by the specificity of the vascular bed of that tissue.

4070

Sloan-Kettering Inst. for Cancer Research
ON THE UTILIZATION OF GUANINE BY THE RAT. M. Earl Balis, Denis H. Marrian, and George Bosworth Brown. [nd] 11p. (AECU-1342)

The administration of guanine-8-C^{14} to the Sherman rat has demonstrated an extremely small utilization of this compound, which escaped detection in previous investigations with N^{15}-labeled guanine.

4071

Sloan-Kettering Inst. for Cancer Research
ON THE ROLES OF GLYCINE AND ADENINE AS PRECURSORS OF NUCLEIC ACID PURINES. Sidney S. Furst and George Bosworth Brown. [nd] 16p. (AECU-1343)

Simultaneous administration of glycine labeled with N^{15} and of adenine labeled with C^{14} in the 8 position was carried out under identical conditions previously used in experiments with adenine (Furst, Roll, and Brown, J. Biol. Chem. 183, 251(1950)) in order to verify unexplained differences of reaction noted for the two compounds. Confirming previous observations, it was found that in nongrowing tissue there must be a continuous formation of some desoxypentose nucleic acids (DNA) from those compounds which are known to be purine building blocks, but that there is an extremely small formation of DNA from dietary adenine. The differences between the results with the two precursors suggest that two mechanisms of the synthesis of nucleic acids, most

notably of desoxyribonucleic acids, are operative. The long-term retention of adenine, once incorporated into DNA during the rapid growth of regenerating liver, is confirmed, and a biochemical stability of at least some DNA is substantiated.

4072

Radiation Lab., Univ. of California
THE SEQUENCE OF HEXOSES IN SUCROSE SYNTHESIS BY PLANTS. A. A. Benson. Mar. 12, 1951. 2p. (UCRL-1179)

The report is reproduced here in its entirety.

It has been concluded by Aronoff and Vernon (Arch. Biochem. 28, 424(1950)) that the mechanism of sucrose synthesis in soybean leaves differs markedly from that previously reported (Calvin et al., Soc. Exptl. Biol. Monograph No. 4, "Carbon Dioxide Fixation" (1950)) with Chlorella, Scenedesmus, and barley leaves. Results obtained in this laboratory are consistent with some of the observations, such as the earlier uniform labeling of the fructose moiety of sucrose, reported by Aronoff and Vernon. However, other evidence presented by these authors suggested prior synthesis of the glucose of sucrose. Although a sequence of reactions similar to the reversal of glycolysis could conceivably result in prior labeling of the glucose moiety, there is as yet no reason to suspect such a unique system of reactions. We have repeated our earlier experiments with soybean leaves (var. Hawkeye) and find labeling of fructose phosphates and the fructose moiety of sucrose prior to that of glucose compounds. As in algae, barley, and geranium, no appreciable amounts of free trioses or hexoses are obtained without enzymatic hydrolysis of phosphate esters. The ratio of fructose to glucose radioactivity in sucrose was found to be 1.8 in 30-sec photosynthesis (PS), Chlorella; 3.0 in 15-sec PS, barley; 3.3 in 15-sec PS, soybean leaf; and 1.05 in 60-sec PS, soybean leaf. The ratio of fructose phosphates to glucose phosphates was 1.0 in 5-sec PS, Scenedesmus; 0.3 in 60-sec PS, Scenedesmus; 14 in 2-sec PS, barley; 0.3 in 30-sec PS, barley; 5 in 5-sec PS, soybean; 0.8 in 15-sec PS, soybean; and 0.8 in 60-sec PS, soybean. The prior appearance of C^{14} in fructose phosphates is in accord with its early predominance in the fructose of sucrose. The general pattern of compounds and the similarity of the kinetics of their synthesis strongly suggests that hexoses are formed by the same pathways in most plants. Although their formation from phosphoglyceric acid by the precise reversal of glycolysis is open to question, it appears that three-carbon compounds are condensed to form ketoses rather than glucose.

4073

Atomic Energy Project, Univ. of Rochester
OBSERVATIONS ON THE ROLE OF PHOSPHATASE IN CALCIFICATION. W. F. Neuman, V. DiStefano, and B. J. Mulryan. Apr. 23, 1951. 17p. (UR-162)

The hypothesis that ester phosphate is inhibitory to calcification in the absence of active phosphatase could explain the role of this enzyme in calcification. In experiments performed to test this notion α glycerophosphate containing radioactive P^{32} was used as a representative ester. It was shown that ester phosphate is strongly adsorbed by bone mineral and that such adsorbed ester inhibits the accretion of additional mineral both in isolated inorganic systems and in calcifying slices of rachitic cartilage taken from rat tibia. Since ester phosphate showed little ability to complex calcium ions in solution, the mechanism seems to involve the interference of the adsorbed ester with the subsequent addition of ions to preformed crystal surfaces. Step-by-step addition of ions to a preformed surface seems a reasonable mechanism in bone formation and presence of an adsorbed organic radical could easily block further addition of ions.

4074

SIGNIFICANCE OF ISOTOPE INVESTIGATIONS AND THEIR APPLICATIONS IN BIOLOGY AND MEDICINE. PART I. Gerhard Schubert, Wolfgang Dittrich, Hans A. Künkel, and Hans-Joachim Schmermund. Strahlentherapie 84, No. 2, 165-224(1951). (In German)

Principal tracer techniques used at the present time in physiology and medicine and therapeutical applications of radioactive isotopes are surveyed. 94 references.

CHEMISTRY

4075

Oak Ridge National Lab., Y-12 Area
PREPARATION OF ANHYDROUS VANADIUM TRIFLUORIDE. T. S. Mackey and K. O. Johnsson. Mar. 13, 1950; Decl. May 15, 1951. 17p. (AECD-3171; y-575)

A procedure has been developed for the preparation of high-purity anhydrous vanadium trifluoride in large batches (5 lb). Using V_2O_5 as the starting material, the procedure involves (1) the removal of N impurities from the V_2O_5 by treatment with wet O at elevated temperatures, (2) the reduction of the V_2O_5 to the trioxide with H, also at elevated temperatures, (3) the reaction of the trioxide with HF to produce hydrated vanadium trifluoride, and (4) the dehydration of the trifluoride at an elevated temperature using anhydrous hydrogen fluoride. (auth)

4076

Ames Lab.
ZIRCONIUM CHLORANILATE COMPLEXES. (Contribution 138). B. J. Thamer and A. F. Voigt. Jan. 3, 1951. 24p. (AECU-1266)

The contribution of B. J. Thamer to this report was taken from part of his Ph.D. thesis, Iowa State College, 1950.

The report is a revision of AECU-879 (see NSA 4-5625). Spectrophotometric measurements at 25°C in 1 to 2M perchloric acid solutions of ionic strength 2 have shown the following equilibria:

$$Zr(IV) + H_2Ch \rightleftharpoons Zr(IV)Ch^{++} + 2H^+, \quad K_1 = (5.69 + 0.08) \times 10^5$$

$$Zr(IV)Ch^{++} + H_2Ch \rightleftharpoons Zr(IV)Ch_2 + 2H^+, \quad K_2 \cong 60^\circ,$$

where Zr(IV) represents the Zr monomer, H_2Ch undissociated chloranilic acid, and the constants are in terms of concentrations. A precipitate that forms in these solutions with concentrations of the reactants of roughly 5×10^{-4} M is shown shown to have a Zr:Ch ratio of 1 to 1.24. A spectrophotometric method was developed for determining Zr at formalities of 2×10^{-6} to 5×10^{-6} using chloranilic acid and measurement at 3400 A. The color reaction proceeds rapidly and yields a true solution that is stable indefinitely. The characteristics of chloranilic acid as a colorimetric reagent for Zr are compared briefly with those of other such reagents. (auth)

4077

Missouri Univ. School of Mines and Metallurgy
FIRST SEMI-ANNUAL REPORT ON STUDY OF CHEMICAL KINETICS OF RAPID REACTIONS; JUNE 1, 1950, TO NOVEMBER 1, 1950. Robert A. Cooley. Nov. 1950. 42p. (AECU-1292)

Brief discussion is made of previous investigations of the reaction of nitrogen dioxide and ammonia. The procedure to be used for investigating the kinetics of the reaction of nitrogen dioxide and ammonia is outlined in some detail. Detailed description is made of experimental apparatus. 10 references.

4078

Illinois Inst. of Tech.
THE FUNDAMENTAL MECHANISMS FOR THE DECOMPOSITION OF ORGANIC MOLECULES BY METAL-PHOTOSENSITIZATION AND OTHER COLLISIONS OF THE SECOND KIND. Harry E. Gunning, Director. Mar. 15, 1951. 10p. (AECU-1295)

Brief summary is made of work to date on the mechanism of decomposition of the cyclic paraffins by Hg $6(^6P_1)$ atoms, the photochemistry of nitrogen-containing compounds, the mechanism of reactions initiated by higher excited states of Hg, and reactions initiated by metastable Hg atoms.

4079

Mendenhall Lab., Ohio State Univ.
THE SOLUBILITY OF He^3 IN LIQUID He^4. J. G. Daunt and C. V. Heer. [nd] 27p. (AECU-1311)

Experiments have been carried out to determine the distribution coefficient of He^3 in liquid He^4 over a wide temperature range. Experimental results are compared with theoretical considerations. A review has been made of previous work of this type both above and below the lambda temperature. 38 references.

4080

Notre Dame Univ.
HOT RADICAL REACTIONS. (A Review of Principles and a Critical Discussion of Experiments). William H. Hamill, Russell R. Williams, Jr., Harold A. Schwarz, and Eugene E. Voiland. Mar. 1, 1951. 49p. (AECU-1321)

The term "hot radical" is used to identify reactants which have an average energy content greater than that of the reacting system. The processes (photodissociation, radiolysis, nuclear reactions, and certain thermal reactions) by which hot radicals are produced, the reactions which they may undergo in contrast to reactions of thermal radicals, and an indication of the nature of experimental tests for these phenomena are considered. Some instances in which the hot radical hypothesis has been or may be advanced have been extracted from the published literature and discussed in detail. These include photolysis of HI, CH_3I and higher alkyl iodide vapors, liquid alkyl iodides, $(CH_3)_2Hg$, acetone, diacetyl, acetyl bromide, and ozone and various Szilard-Chalmers reactions. Some hot-radical reaction efficiencies are summarized. 44 references.

4081

Notre Dame Univ.
FREE RADICALS IN PYROLYSIS OF PROPIONALDEHYDE. Thomas J. Sworski and Milton Burton. [nd] 10p. (AECU-1323)

Study of pyrolysis of propionaldehyde by mercury-mirror technique in the range 850 to 950°C indicates production of a mixture of free methyl and ethyl radicals with the latter predominating. Increase of the ratio CH_3/C_2H_5 with increase of temperature cannot be explained on the basis of competing primary processes but is attributed instead to secondary reactions involving ethyl radical, notably a reaction with free H atoms. Detection of ethyl radical despite its apparent thermal instability is attributed to its important role as chain propagator in this pyrolysis. (auth)

4082

Ames Lab.
KINETICS OF THE PERIODATE OXIDATION OF MANGANESE TO PERMANGANATE. Glenn R. Waterbury, Anson Mack Hayes, and Don S. Martin, Jr. May 21, 1951. 25p. (AECU-1339)

The kinetics of the oxidation of Mn have been studied using a spectrophotometric method. The oxidation of Mn(II) was found to be autocatalytic. The rate dependence was first order in both Mn(II) and periodate and half order in permanganate. The dependence on $HClO_4$ concentration was complex, and the observed rates passed through a minimum. In concentrated iodic acid solutions it was demonstrated that an appreciable quantity of an iodate complex of Mn(III) was formed. The rate dependence of this complex for the formation of permanganate approached first order in the complex and second order in periodate. Some other properties of the Mn(III) iodate complex are reported. A mechanism for the oxidation has been proposed to explain the rate dependences as well as some other effects observed.

4083

Ames Lab.
CONTRIBUTIONS TO THE CHEMISTRY OF THE vic-DIOXIMES; XI. INFRARED SPECTROPHOTOMETRIC STUDY OF THE NATURE OF THE HYDROGEN BOND IN 1,2-BIS(vic-DIOXIMO-N,N')NICKEL(II) COMPOUNDS. Roger C. Voter, Charles V. Banks, Velmer A. Fassel, and Paul W. Kehres. May 25, 1951. 22p. (AECU-1347)

The gross structural features of the inner-complex compounds formed by the reaction of the vic-dioximes with Ni

and Pd ions have been well established by various chemical and physical means. Published chemical results support the supposition that H bonding occurs between the remaining oxime hydrogens and the proximate oxygens of the nitrone-form oxime groups. However, infrared spectrophotometric evidence is presented to show that, in the Ni inner-complex compounds of several vic-dioximes, the characteristic absorption maxima normally attributed to O–H bonds are not detected in the usual region. These maxima, shifted slightly to lower frequencies because of intermolecular association, are noted in the spectra of the corresponding solid vic-dioximes. The conclusion is drawn that the oxime hydrogens of the metal derivatives are present in an O–H–O structure unlike that observed in normal hydrogen bonds. 25 references. (auth)

4084

Brookhaven National Lab.
CHEMISTRY DEPARTMENT, p.49-108 of QUARTERLY PROGRESS REPORT; OCTOBER 1 - DECEMBER 31, 1950. Mar. 1951. 60p. (BNL-93(p.49-108))

The following reports are given in the final form, complete with abstracts, in which they have appeared or will appear in the literature: "Absorption Spectra of UCl_4 and UCl_3 at 77°K in Solid and Solution," S. Freed and K. Sancier; "Absorption Spectra of Gadolinium Bromide and Europium Chloride," S. Freed and K. Sancier; "The Absorption Spectra at Low Temperatures of Solutions of Chlorophyll a and of Chlorophyll b," S. Freed and K. Sancier; "Decomposition of Water and Dilute Halide Solutions with 2-Mev X-Rays," E. R. Johnson and A. O. Allen; "Studies on the Decomposition of Hydrogen Peroxide Solutions with 2-Mev X-Rays," E. R. Johnson; "Dosimetry of 2-Mev X-Rays," A. Levy and A. O. Allen; "Temperature and Chloride Effects on the Rate of the Ferrous-Ferric Exchange Reaction," J. Silverman and R. W. Dodson; "Effect of Chloride on the Thallous-Thallic Exchange Reaction," L. Eimer and R. W. Dodson; "Ferrocyanide-Ferricyanide Exchange Reaction," L. Eimer and R. W. Dodson; "Kinetics of the Exchange of Nickel Ion with Nickel Ethylenediaminetetra-Acetate Ion," C. M. Cook, Jr., and F. A. Long, "Studies on the Mechanism of the Willgerodt Reaction. I. The Over-All Mechanism," E. V. Brown, E. Cerwonka, and R. C. Anderson; "Normal Coordinates for the Isotopic Acetylene Molecules HCCH, HCCD, and DCCD," O. A. Schaeffer; "The Relative Abundances of the Isotopes of Krypton and Neon," O. A. Schaeffer; "The Determination of Deuterium in Water," L. Freedman and A. P. Irsa; "Szilard-Chalmers Separations with Metal-TTA Complexes," J. A. Miskel; "Half-Life of I^{129} and the Age of the Elements," S. Katcoff, O. A. Schaeffer, and J. M. Hastings; "Emission of Lead X-rays in the Decay of Po^{210}," W. Rubinson and W. Bernstein.

4085

Ames Lab.
ANNOTATED BIBLIOGRAPHY OF 1,2-CYCLOHEXANEDIONEDIOXIME. James L. Pflasterer and Charles V. Banks. May 9, 1951. 22p. (ISC-136)

The bibliography presents abstracts of 22 articles, published between 1923 and 1950; American as well as foreign literature is considered.

4086

Rensselaer Polytechnic Inst.
SECOND ANNUAL REPORT. L. G. Bassett. Nov. 1, 1950. 7p. (NYO-616)

A study of the solvent extraction of inorganic ions has been made of the ferric chloride–isopropyl ether system, and the uranyl nitrate–diethyl ether system using infrared absorption measurements. The infrared results have demonstrated the existence of the UO_2^{++} ion and the NO_3^- in the organic phase. Attempts to correlate the ability of oxygenated solvents to donate electrons (i.e., accept a proton and deuteron) and to extract the inorganic salts mentioned were successful on a qualitative but not on a quantitative basis. Refractive index measurements on the aqueous phase of the ferric chloride–hydrochloric acid system gave no indication of complex formation. However, ultraviolet absorption measurements demonstrated the presence of a $Fe(OH)_x$ complex at low acidities and of a $Fe(Cl)^{++}$ complex when chloride ion was present. The association constant for the formation of the $Fe(Cl)^{++}$ complex was calculated at both low and moderate ionic strengths. The work described in this report is described in greater detail in reports RPIB-1, -2, and -3, and NYO-607, -608, -609, -610, and -611. (auth)

4087

Syracuse Univ.
PHOTOCHEMICAL REACTIONS OF COMPLEX MOLECULES IN CONDENSED PHASE. Henry Linschitz. Dec. 7, 1950. 46p. (NYO-654)

A new reversible reaction has been found, between photosensitizing dyes (chlorophyll and eosin) and quinones (1-4 benzo- and 1-4 naphthoquinone). Absorption spectra have been taken in the "bleached state," at low temperature. The results are interpreted in terms of possible mechanisms of photosensitization, involving the intermediate formation of dye and substrate semiquinones. Evidence is presented indicating that there are several phosphorescent states in certain dyes. The phosphorescence spectrum of fluorescein in phosphoric acid glass depends on the excitation frequency which carries the molecule into the fluorescent level. A new type of phosphorescence is described, which occurs in organic phosphors in rigid solvents. The effect consists in a burst of light which appears after the decay of phosphorescence when the rigid solvent is melted, and has been demonstrated for a wide variety of compounds. Methods have been developed for polarographic measurements in pure ethanol. Chlorophyll in acetate-buffered ethanol shows three polarographic waves, at reduction potentials of 0.6, 1.1, and 1.3 volts, respectively. Zinc tetraphenylporphine has been prepared as starting material for the synthesis of a series of porphyrins. The chemiluminescent reaction between porphyrins and peroxides is being investigated.

4088

Pennsylvania State Coll.
A POTENTIOMETRIC STUDY OF BETA-DIKETONE CHELATION TENDENCIES. LeGrand G. Van Uitert Jan. 10, 1951. 113p. (NYO-725)

The methods of procedure of Calvin and Wilson (J. Am. Chem. Soc. 67, 2003(1945)) for obtaining formation constants

by potentiometric titrations have been substantiated. These methods have been extended to water-dioxane solutions containing more than 50 vol. % of dioxane. The interpretation of the pH data obtained in these titrations has been clarified. The effect of the ionic strength and the water-dioxane ratio upon the dissociation constants of the materials present in water-dioxane solutions has been demonstrated. The dissociation constants of a series of β-diketones in 75 vol. % dioxane solutions have been measured and related to the formation constants of their respective Cu chelate compounds. The existence of insoluble compounds of the general formula $M^{+2}(Ke)_2 \cdot M^{+1}Ke$.dioxane, where Ke is the ionized acetylacetone molecule, has been demonstrated. This has been shown specifically for $NiKe_2$.NaKe.dioxane and $ZnKe_2$·NaKe.dioxane. The instability of trifluoro-beta-diketones in the presence of acid has been demonstrated. (auth)

4089

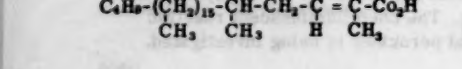
Pennsylvania State Coll.
A POTENTIOMETRIC STUDY OF BETA-DIKETONE CHELATION TENDENCIES; II. LeGrand G. Van Uitert, W. Conard Fernelius, and Bodie E. Douglas. Mar. 1, 1951. 42p. (NYO-726)

A previous report (NYO-725) gave dissociation constants of a series of β-diketones, and formation constants for the Cu(II) derivatives of these diketones to determine the effect of acidity of the chelating agent on the stability of the chelate formed with Cu(II). In this report data for the chelation of Cu with three additional β-diketones are given, the acid dissociation constants of the trifluoro-β-diketones are remeasured while reducing hydrolysis to a minimum, values for the previously given formation constant, log k_1, for metal derivatives of trifluoro-β-diketones are considered to be unreliable, and chelating tendencies of the diketones with Ni ion are studied. These are similar to those found with Cu, except for the tendency to form $NaNiCh_3$.

4090

Radiation Lab., Univ. of California
BRANCHED-CHAIN FATTY ACIDS; XXIII. THE PRINCIPAL STRUCTURAL FEATURES OF C_{27}-PHTHIENOIC ACID. James Cason, N. K. Freeman, and Gene Sumrell. Mar. 1951. 19p. (UCRL-1157)

The structure of C_{27}-phthienoic acid has been further investigated by use of infrared spectra, study of the behavior of the acid on heating, and study of the rate of hydrolysis of C_{27}-phthianamide. The known structural features of this acid are shown in the following formula:



(auth)

4091

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
CHEMISTRY OF THE FISSION ELEMENTS GROUP, sect. 1 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. D. N. Hume and L. B. Rogers. Jan. 1, 1951. 5p. (NP-1857(sect.1))

Brief summaries are presented of studies of Cd thiocyanate complex in aqueous solutions, polarography of Cd cyanide system, Pb nitrate complex, photometric titration, flame photometry, fundamentals of polarography, electroseparation of carrier-free tracers, electrolytic separations using a mercury cathode, quantitative microanalytical procedures for Ag, and precision counting of radioactive liquids.

4092

LIFE-TIME OF THE LITHIUM ATOMIC RESONANCE STATES. G. Stephenson. Nature 167, 156(1951) Jan. 27. (Letter to the editor)

The lifetime of the Li resonance states has been determined to be 2.8×10^{-8} sec. This value and that of the oscillator strength corresponding to the transition ($2^2S_{1/2} - 2^2P$) has been obtained by a total-absorption method which involves the integral of the absorption coefficient over the whole absorption line. The value of this integral was obtained by photographic densitometry of the spectogram obtained by the use of a 10-ft grating instrument. The resulting value for the lifetime of the Li resonance states was in close agreement with the theoretical value of 2.7×10^{-8} sec.

4093

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP, sect. 5 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. C. D. Coryell and J. W. Irvine, Jr. Jan. 1, 1951. 11p. (NP-1857(sect.5))

Phosphors for Scintillation Counters. A number of plastic and crystal phosphors that have been specially purified are listed. Inorganic Syntheses: Tetrakistrichlorophosphine Nickel and Related Zero-Valent Complexes. The synthesis in large quantities of $Ni(PCl_3)_4$ by direct action in the liquid phase of PCl_3 on $Ni(CO)_4$ and the properties of the resulting compound are described in detail. Attempts to prepare replacement compounds of W, Cr, and Mo carbonyls with PCl_3 and PBr_3, $Ni(CO)_4$ with $AsCl_3$ or $SbCl_3$, and $Ni(CO)_4$ with PF_3 are discussed. Ion-Exchange Studies: Electrochemistry of Ion-Exchange Resins. A study has been made of the influence of resin particle size and applied voltage on the electrolysis of the sodium form of the ion-exchange resin Dowex-50 (NaR). Further information on the nature of resin electrolysis has been obtained using the technique of marking a lamina of a horizontal resin column with radiosodium and following the electromigration of the tagged lamina. The results are tabulated, and the electrolysis reaction and spread of the radiosodium band are discussed in some detail. Radiochemical Studies of Fission Products: Antimony Isotopes in Fission. A 1.1-hr isotope, probably Sb^{128}, has been isolated from a long irradiation of UO_3. The antimony isotopes in this region (half lives as determined in this laboratory) with their fission yields are 99-hr Sb^{127}, 0.08%; 1.1-hr Sb^{128}, 0.1%; 4.6-hr Sb^{129}, 0.2%; 23.1-min Sb^{131}, 1.5%; 4.4-min Sb^{133}, 3.8%. The anomalous high yield of Sb^{133} is attributed to excessive neutron emission of Sb^{134}. Relative Yields of Isomeric Pairs. The ratio of the cross sections for Zn^{69m} and Zn^{69} as a function of deuteron energy for each of the reactions $Zn^{68}(d,p)Zn^{69}$ and $Ga^{71}(d,\alpha)Zn^{69}$ is presented in graphical form. Consideration

of Nuclear Stability. A brief theoretical discussion of nuclear stabilities for the mass numbers 123 to 161 with special consideration to Pm isotopes is presented.

4094

ON DIFFUSION KINETICS IN CHEMICAL REACTIONS TAKING PLACE IN SPHERICAL POWDER GRAINS. A. M. Ginstling and B. I. Brounshteĭn. Zhur. Priklad. Khim. 23, 1249-59(1950) Dec. (In Russian)

Diffusion in spherical grains, although one of the main processes in the many solid-phase reactions now in use, has been little studied. When two substances, A and B, react with the formation of layers of the product AB around grains of B, the kinetics of the whole process is determined by the rate of diffusion of A through AB, because this diffusion is very much slower than the reaction. Equations of the diffusion kinetics are derived, and it is seen that the rate of thickening of the AB layer is a function, not only of the momentary value x of the thickness, but also of the ratio between the latter and the original radius R of the grain; a minimum rate corresponds to $x = \frac{1}{2}R$. Limits of applicability to spherical grains of Jander's equations (Z. anorg. u. allgem. Chem. 163, 1(1927)), generally employed in studies of solid-phase reactions, are shown.

4095

SOME AMINO-DERIVATIVES OF BORINE. G. E. Coates. J. Chem. Soc., 3481-3(1950) Dec.

Whereas $Me_2N.BX_2$ (X = H or Cl) associates, giving remarkably stable dimers, $(Me_2N)_2BH$ and $(Me_2N)_2BCl$ are monomeric. Attempted preparation of bis(dimethylamino)-methylborine gave only the disproportionation products dimethylaminodimethylborine and trisdimethylaminoborine. The former product and methanol give a 1:1 addition product, which with hydrogen chloride forms dimethylamine hydrochloride and methyl dimethylboronate. The 1:1 coordination complex is also formed directly from dimethylamine and methyl dimethylboronate. Lithium aluminum hydride reduction of chlorobisdimethylaminoborine gives the monomeric bisdimethylaminoborine. (auth)

ANALYTICAL PROCEDURES

4096

Brookhaven National Lab.
DETERMINATION OF TOTAL CARBON AND ITS RADIOACTIVITY. Donald D. Van Slyke, Robert Steele, and John Plazin. [nd] 77p. (AECU-1307)

An abstract of this report was indexed as report AECU-1132 and appeared in Nuclear Science Abstracts as NSA 5-2408.

4097

Chemical Research Lab., Teddington
THE DETERMINATION OF GOLD BY SOLVENT EXTRACTION IN THE PRESENCE OF CELLULOSE. N. F. Kember, D. Rees Evans, Patricia Swain, and R. A. Wells. Nov. 1950. 16p. (CRL-AE-74)

Methods are described for the quantitative separation of microamounts of Au from a large number of other metals, with the aid of paper-strip chromatography, and for the separation and determination of larger quantities of Au, employing a column of cellulose. In both procedures the solvent used is a mixture of ethyl acetate, water, and HNO_3. Special attention has been given to the separation of Au from the Pt metals (Rh, Pd, Ir, and Pt). (auth)

4098

Mines Branch, Ottawa
THE DETERMINATION OF URANIUM IN ORES—FLUOROPHOTOMETRIC METHOD. (Topical Report No. TR-66/50). J. B. Zimmerman. Nov. 14, 1950. 29p. (NP-3052)

The procedures and equipment used in the quantitative analysis of U ores by the fluorophotometric method are described in detail. This method of analysis for U_3O_8 has proved entirely satisfactory for U concentrations up to 1.0%.

4099

Commissariat à l'Énergie Atomique
NEUTRON AUTORADIOGRAPHY; SEPARATE DETERMINATIONS OF URANIUM AND THORIUM IN COMPOUNDS; extract from Compt. rend. 232, 956-961. (In French) Irène Curie and Henriette Faraggi. Mar. 5, 1951. 3p. (CEA-71)

Since Th is fissioned only by fast neutrons, separate determination of the U and Th concentrations in minerals is possible by irradiating with thermal neutrons a rock sample in close contact with a nuclear emulsion. The fission tracks observed determine the distribution and concentration of U in the rock; α-particle autoradiography permits the determination of Th by difference. Technique of emulsion development and application of the method to samples of autunite, thorite, and euxenite are described. The precision of the U determination is about 6%.

4100

OXIDATION OF GERMANIUM(II) ON THE MERCURY DROP ELECTRODE AND ITS APPLICATION IN ANALYSIS. D. Cozzi and S. Vivarelli. Mikrochemie ver. Mikrochim. Acta 36-37, 594-600(1951). (In German)

Ge(II), obtained by reduction of Ge(IV) with sodium hypophosphite on the mercury-drop electrode, gives an anode stage in acid solutions which is proportional to the concentration. The effect of the Cl^- ion excess on the height of the stage can be neutralized by using Cd^{++} solutions. Quantitative determinations at concentrations as low as 10^{-5}M can be made with no interference by the metals usually present. (auth)

4101

USE OF RADIOELEMENTS IN THE STUDY OF OXIDE CATHODES. Jean Debiesse, Jean Challansonnet, and Georges Neyret. Compt. rend. 232, 602-4(1951) Feb. 12. (In French)

Experiments indicating that very sensitive qualitative and quantitative determination of Co in Ni alloys or in oxide cathodes containing Ni, Co, Mg, Cu, Fe, Mn, and Si is possible by pile activation are reported.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4102

Brookhaven National Lab.
THE EPITAXY OF ALKALI CHLORIDES ON METALS. G. W. Johnson. Nov. 2, 1950. 44p. (AECU-1175)

The oriented growth of alkali chlorides from solution on the surfaces of various metals has been investigated. Oriented growth occurred on metals extending from the true metals, such as Ag and Cu, to the almost nonmetals, Bi and Sb. It is shown that in most cases growth probably took place on top of an oxide film; in those cases for which oriented growth was found on a readily oxidized surface, it is concluded that the oxide was also oriented on the metal. Photomicrographs illustrate the oriented growth of the chlorides on various metals. 36 references.

FLUORINE AND FLUORINE COMPOUNDS

4103

DIRECTED HALOGENATION IN FLUORINATED AROMATIC COMPOUNDS. J. D. Park, H. A. Brown, and J. R. Lacher. J. Am. Chem. Soc. 73, 709-11(1951) Feb.

A method for chlorinating the two compounds α,α-dichloro-β,β,β-trifluoroethylbenzene and m-chloro-α,α-dichloro-β,β,β-trifluoroethylbenzene in sealed pyrex tubes is discussed. From these studies it is found that the $-COCF_3$ and the $-CCl_2CF_3$ groups, like the $-CF_3$ group, are meta directors in electrophilic aromatic substitution reactions. The physical properties, including infrared absorption spectra, of several aromatic compounds containing the trifluoromethyl group are reported. (auth)

4104

Minnesota Mining and Mfg. Co.
QUARTERLY PROGRESS REPORT NO. 7; NOVEMBER 1950 - JANUARY 1951. W. H. Pearlson. Mar. 19, 1951. 27p. (NP-3060)

Preliminary polymerization and copolymerization studies of 2-(perfluoropropyl) and 2-(perfluoroamyl) propene were unsuccessful. Perfluorononene-1, the highest perfluoroolefin yet studied, appears to follow the same reaction pattern as the lower olefins, being resistant toward peroxide-initiated homopolymerization and copolymerizing with vinyl ethers. The vinyl esters of the perfluoro acids have been studied extensively. Polymers have been obtained from bulk and solution experiments, but aqueous emulsion polymerization has resulted in extensive hydrolysis of the monomers. Polyperfluorobutyl acrylate has been prepared with a brittle point of about −25°C which shows only a few per cent volume increase after immersion in a 70:30 isooctane:toluene mixture. The incorporation of butadiene as a comonomer has reduced the brittle temperature to as low as −70°C. Several copolymers with varying butadiene content have been prepared. The increased low-temperature flexibility has been accompanied by a decrease in solvent resistance as the fluorine content of the polymer is lowered. Other dienes have also been investigated. Plasticization of the polymer has been cursorily studied. Curing of the polymer has been developed materially. Modification of the earlier oxide-polyamine cure resulted in a marked decrease in brittle point. A second type of recipe has produced a silicate-cured vulcanizate with a brittle temperature of −25°C and a tensile strength of 720 psi and excellent solvent resistance. (auth)

LABORATORIES AND EQUIPMENT

4105

Atomic Energy Project, Univ. of California, Los Angeles
AN IMPROVED BOAT FOR COLLECTING THIN SECTIONS FOR ELECTRON MICROSCOPY. Francis W. Bishop and Sylvia B. Elliott. May 9, 1951. 7p. (UCLA-134)

For collecting and straightening out of the very thin sections needed in electron microscopy a boat of brass which is clamped directly to the microtome knife without gaskets is described. The boat contains a suitable liquid whose level can be adjusted with a screw while cutting. Provision is made for picking up complete ribbons on a slide. 4 figures.

4106

Radiation Lab., Univ. of California
ELECTRICAL CONTROL SYSTEM FOR RESEARCH LABORATORIES. Vern F. Denton, Jas. D. Fahey, and J. C. Kilpatrick. Mar. 9, 1951. 28p. (UCRL-1172)

The established system of control equipment and methods of control wiring used for particle accelerators at the University of California Radiation Laboratory is outlined. The standard equipment racks, cross-connecting racks, gutters and raceways, and control-equipment panels are illustrated and described, and the equipment numbering, installation procedures, and records are discussed.

4107

Commissariat à l'Énergie Atomique
MANIPULATION OF RADIOACTIVE ELEMENTS; extract from Ing. tech. No. 30 (1951). C. Fisher. Feb. 1951. 3p. (CEA-70)

Laboratory handling of radioactive materials is briefly discussed.

RADIATION EFFECTS

4108

Notre Dame Univ.
EFFECT OF RING ON RADIATION CHEMISTRY OF ALKYL-SATURATED BENZENES. Milton Burton, Sheffield Gordon, and Robert R. Hentz. [nd] 12p. (AECU-1306)

Photolysis of liquid alkyl benzenes at 2537 A produces gas volatile at −120°C with quantum yield of the order of 10^{-4}. Energy absorbed in the π-electron system of the benzene ring causes rupture preferentially of bonds β to the ring, with the weaker bonds being most affected. Radiolysis of the same compounds with 1.5-Mev electrons gives 100-ev

yields (G values) of the order of 0.2. Calculated primary G values according to the rule of averages (allowing for radical absorption by benzene rings) are much higher than those estimated directly from the data given. The discrepancy is attributed to a real protective effect, of the so-called "sponge" type, by the benzene nucleus. In this type of protection energy originally liberated in the alkyl group by the radiation, either as excitation or ionization, is transferred to the ring and dissipated. Transfer of energy from the ring to the side group, with an ensuant chemical effect, also occurs, but such destructive effects play a minor role in comparison with protection. (auth)

4109

Notre Dame Univ.
ELEMENTARY PROCESSES IN RADIATION CHEMISTRY; II. NEGATIVE ION FORMATION BY ELECTRON CAPTURE IN NEUTRAL MOLECULES. John L. Magee and Milton Burton. [nd] 38p. (AECU-1319)

The processes of ionization characteristic of radiation chemistry yield energetic electrons which are degraded to thermal energies in ionization processes and in collisions. Provided satisfactory conditions for negative ion formation exist, thermal electrons disappear almost exclusively in formation of negative ions rather than in neutralization of positive ions. Common substances which give negative ions by thermal electron capture at the usual irradiation intensities employed include O_2, H_2O, alcohols, alkyl halides, and, in general, all compounds having low-lying vacant orbitals. The radiation chemical syntheses of ozone and of H_2O_2 show behavior characteristic of reactions in which the principal neutralization process involves negative O ions. When a negative ion source (e.g., O_2 or water) is present even as an impurity in a substance of low ionization potential (e.g., benzene), the principal neutralization reaction in a radiation-chemical process involves interaction of the negative ion of the former and of the positive ion of the latter. Water vapor captures thermal electrons without dissociation but, in liquid water, solvation of the negative ion gives it large electron affinity and thus produces a situation conducive to capture accompanied by dissociation. The resultant anisotropic distribution and high concentration of positive and negative ions may have special consequences, particularly in biological systems.

4110

Notre Dame Univ.
A STUDY OF EFFECT OF IMPINGEMENT PARTICLE VELOCITY IN RADIOLYSIS OF SOME AROMATIC HYDROCARBONS. Thomas J. Sworski and Milton Burton. [nd] 11p. (AECU-1320)

The chemical effects of electron irradiation of toluene, ethylbenzene, i-propylbenzene, and t-butylbenzene have already been reported; effects of pile irradiation in the Oak Ridge nuclear reactor to determine effect of particle size, are reported here. Total gas 100-ev yields (G values) of these compounds are, respectively, 0.18, 0.27, 0.27, and 0.22, all values being slightly higher (10 to 30%) than yields obtained in electron bombardment radiolysis. At the same time, in every case studied, the ratio $G(H_2)/G(CH_4)$ is increased in reactor exposures over the ratio in electron bombardment by a factor of approximately 2, the factor increasing in the order of listing above. The result is not explicable on any simple basis of density of ionization in the particle track, but may require consideration of average energy transfer to a molecule as a function of particle velocity or of differences in secondary processes involving, respectively, atomic H and free methyl.

4111

Notre Dame Univ.
AN INTRODUCTION TO RADIATION CHEMISTRY. Milton Burton. [nd] 74p. (AECU-1344)

Radiation chemistry is the chemistry of the effects of high-energy particles and radiations, including both radioactive emanations and the energetic products of high-voltage machines and nuclear reactors. The present extensive review covers the history, theory, and techniques of radiochemistry. The primary effects of radiation, effect of state of molecules being irradiated, resonance stabilization, contribution of negative ions, ionization and excitation transfer, the radiation chemistry of water and solids, and radiobiology are considered. Promising fields for research are suggested.

4112

Wisconsin Univ.
EVIDENCE ON THE MECHANISM OF LIQUID PHASE REACTIONS OF BROMINE ACTIVATED BY RADIATIVE NEUTRON CAPTURE AND BY ISOMERIC TRANSITION. (abstract). R. S. H. Chiang, J. Hornig, and J. E. Willard. [nd] 2p. (AECU-1345)

The report is reproduced here in its entirety.

It has been demonstrated earlier (J. Am. Chem. Soc. 64, 1342(1942)) that when Br_2 undergoes radiative neutron capture or isomeric transition in CCl_4 the radioactive organic products include CCl_3Br, CCl_2Br_2, and one or more higher-boiling species. We have now determined what fraction of the nuclear events leads to each of these products at Br concentrations from 0.1 to 75 mole %. We have also determined the organic yield from the isomeric transition of Br initially present as CCl_3Br^{80} (4.4 hr) at a concentration of 0.04 mole % in liquid Br_2 and at various concentrations of Br_2 in CCl_4. For all 3 types of reaction: the (n,γ) and the isomeric transition activated reactions of Br_2 in CCl_4, and the isomeric transition activated reaction of CCl_3Br, the organic yield falls off sharply with increasing concentration of Br_2 over the range of the first few mole % added, but then decreases much more slowly. This behavior is similar to that observed earlier for the (n,γ) reaction on liquid C_2H_5I and C_2H_5Br with added free halogen, and suggests that a significant fraction of the atoms activated by the nuclear events reenter stable combination only after a finite period of existence as normal thermal atoms. The fact that CCl_2Br_2 and higher-boiling compounds are formed by both the (n,γ) reaction and the isomeric transition reaction even in dilute solutions of bromine in CCl_4 (1 mole % and less), suggests that radicals which have been formed by the loss of two or more chlorine atoms from CCl_4 must exist for times sufficient to encounter Br molecules by diffusion. The formation of CCl_3Br in systems containing 25 mole % CCl_4 and 75 mole % Br_2 seems to indicate that some of the hot atom processes occur by the simple

billiard-ball mechanism wherein a chlorine atom is knocked from a CCl_4 molecule leaving a CCl_3 radical adjacent to the cooled hot atom. It has been observed that the isomeric transition of bromine in CCl_3Br^{80} (4.4 hr) gives 55% organic yield at a CCl_3Br concentration of 0.04 m % in CCl_4, gives 28% organic yield when 38 mole % of Br_2 is present in the system, and still gives a measurable organic yield when the system consists of 0.04 mole % of CCl_3Br in 99.96% liquid Br_2. The latter result must indicate that under these conditions an appreciable fraction of the isomeric transitions either do not break the C−Br bond or that recombination occurs within the parent cage.

RARE EARTHS AND RARE-EARTH COMPOUNDS

4113

Ames Lab.
THE THEORY AND KINETICS OF SPECIFIC OXIDATION; IV. THE CERATE-2,3 BUTANEDIOL REACTIONS IN PERCHLORATE SOLUTIONS. Frederick R. Duke and Robert F. Bremer. May 16, 1951. 13p. (AECU-1340)

The nature of tetravalent Ce in perchlorate solutions was studied by calculating rate constants and equilibrium constants from kinetic data. Tetravalent Ce does not coordinate perchlorate ion. Ce(IV) in perchlorate solutions coordinates only hydroxyl ions or water. Tetravalent Ce is capable of coordinating glycol to form mono- and di-glycolated complexes. No evidence of formation of the tri-glycolated species was found. That butanediol is oxidized by Ce only after complex formation is offered as further proof of the theory of intermediate complex formation.

SEPARATION PROCEDURES

4114

Minnesota Univ. School of Forestry
PARTITION CHROMATOGRAPHY OF THE AZO-DYES OF HISTIDINE AND TYROSINE. James E. De Vay, Wen-Hua Chang, and Ralph L. Hossfeld. Jan. 29, 1951. 3p. (AECU-1335)

A modification of Hossfeld's method for partition chromatography of simple phenols (J. Am. Chem. Soc. (1951) Feb.) proved to be a satisfactory chromatographic separation of histidine and tyrosine. These were coupled with diazotized p-nitroaniline in presence of 4% sodium carbonate, spotted on Whatman No. 1 filter paper, and developed by irrigation with secondary butanol.

4115

Stanford Research Inst.
CONTINUOUS SEPARATION OF IONS BY MEANS OF A MOVING ION EXCHANGE BED; TECHNICAL REPORT NO. 6 COVERING PERIOD JUNE 25, 1950 - JANUARY 31, 1951. Nevin K. Hiester. Mar. 30, 1951. 150p. (COO-41)

The forms of the equations describing the kinetics and equilibria of ion-exchange processes have been reviewed. The previously proposed design theories for predicting the behavior of both fixed-bed and moving-bed operation are also discussed. Additional design theory procedures not previously proposed are outlined. The most important of these new methods is a set of equations based upon a simple rate mechanism for the exchange of trace components which predicts the behavior of moving-bed units for both ion removal and ion separation. Three separate models of the separation apparatus have been studied and the operating characteristics for each have been determined. The third model, involving a mechanical lift system for the transfer of the resin, has proved the most successful. Experimental runs on the second and third models definitely show the feasibility of both the separation and removal steps of the process. The runs involving top and bottom reflux in the separation step have verified the necessity for the utilization of reflux. Under reflux conditions, runs have been made in which excellent separation of the ions has been obtained. (auth)

4116

AN ABSORPTION METHOD FOR THE EXTRACTION OF KRYPTON AND XENON; PART I; trans. from Zhur. Obscheĭ Khim. 9, No. 18, 1666-1673 (1939). V. G. Fastovskiy. Jan. 27, 1951. 18p. (NP-2302)

The absorption method has been applied to the separation of Kr and Xe from a concentrate. Measurements have been cited on the adsorption of O_2, Ar, and Kr by silica gel for temperatures of −55, −93, and −120°C and for pressure between 0 and 1000 mm Hg. The basic factors of the process have been discussed with the purpose of showing its optimum parameters. 14 references.

4117

Mines Branch, Ottawa
THE CHEMICAL DETERMINATION OF THORIUM IN ITS ORES. John C. Ingles. Feb. 1951. 28p. (NP-3069)

A number of procedures for the separation and determination of Th have been investigated and evaluated. Results of the colorimetric determination of Th using the colorimetric reagent 1-(o-arsonophenylazo) -2 naphthol 3-6 disulfonic acid are discussed. As this reagent was not available commercially the synthesis is described. The method for the colorimetric determination of Ce is described. Methods for the decomposition of U ores including treatment with HNO_3, HCl, and H_2SO_4, fusion with $KHSO_4$, and NaOH sinter have been considered for Th-bearing ores. Results are given of separations of Th from the common interfering ions by the fluoride and the oxalate separation processes. The mandelic acid separation process for the separation of Th from Zr has been evaluated. An investigation of the ammonium benzoate, the hexamine, the urea-formate, and the mesityl oxide separation processes has been made as to their applicability to the separation of Th from the rare earths. Separation results of each of these processes are tabulated. On the basis of the experimental work carried out, a recommended procedure for the determination of Th in ores has been formulated.

SORPTION PHENOMENA

4118

THE CALCULATION OF DIFFUSION COEFFICIENTS FROM SORPTION DATA. Stephen Prager. J. Chem. Phys. 19, 537-41(1951) May.

A method is described for the calculation of the dependence of the diffusion coefficient on the concentration of diffusing material from data obtained by studying the rates of sorption of vapors by films. The principle of the method is to approximate the actual concentration dependence by a step function. For such a function the differential equations involved can be solved analytically, and the heights of the individual steps can be computed; the step function is then smoothed out by an averaging process. The method has been tried out for the sorption of isobutane by polyisobutylene at 35°C and found to be quite satisfactory. (auth)

SPECTROSCOPY

4119

ON THE TEMPERATURE AND PRESSURE DEPENDENCE OF ELECTRONIC TERMS IN CRYSTALS. H. K. Paetzold. Z. Physik 129, 123-39(1951) Feb. 13. (In German)

The shift of spectral lines of Nd^{+3} in $Pr(Nd)(NO_3)_3.6H_2O$ crystals, and of Cr^{+3} in alexandrite and ruby, as produced by temperature and pressure changes, was measured.

SYNTHESES

4120

California Univ., Berkeley
PREPARATION OF L-ARABINOSE-1-C^{14}. D. A. Rappoport and W. Z. Hassid. [nd] 5p. (AECU-1333)

L-arabinose-1-C^{14} was prepared by condensation of L-erythrose with nitromethane-C^{14}. It was separated from L-ribose-1-C^{14} by partition chromatography on a cellulose column and purified by partition chromatography on paper.

4121

Texas Agricultural Experiment Station
THE SYNTHESIS OF C-14 LABELED GLYCEROL. Hermann Schlenk and C. Bernice Wallace-DeHaas. [nd] 10p. (ORO-31)

The synthesis of glycerol labeled in the α position with C^{14} is described in a yield of 19.1% (3.95 g). The starting materials were nitromethane and labeled paraformaldehyde. Other possibilities for a synthesis of radioactive glycerol were evaluated. (auth)

TRACER APPLICATIONS

4122

Harvard Univ. and Brookhaven National Lab.
THE FAWORSKII REARRANGEMENT OF α-HALOKETONES. Robert B. Loftfield. [nd] 28p. (AECU-1309)

An abstract of this report was issued and indexed as report AECU-1142 and appeared in Nuclear Science Abstracts as NSA 5-3114.

4123

College of Agriculture, Univ. of California
FERMENTATION OF L-ARABINOSE-1-C^{14} BY LACTOBACILLUS PENTOACETICUS. [nd] 2p. (AECU-1312)

Lactobacillus pentoaceticus converts 1 mole of L-arabinose almost quantitatively to 1 mole each of acetic and lactic acids. Experiments in which C^{14} was used as a tracer show that the methyl carbon of acetic acid is derived from carbon 1 of L-arabinose; the carboxyl carbon from carbon 2 of arabinose; and the lactic acid from carbons 3, 4, and 5. Indirect evidence for a new type of organic fission reaction is provided.

4124

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (ORGANIC) GROUP, sect. 6 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. J. D. Roberts. Jan. 1, 1951. 4p. (NP-1857(sect.6))

Preliminary results of studies on carbonium-ion rearrangements in solvolysis of norbornyl-2,3-C_1^{14} p-bromobenzenesulfonate, treatment of cyclopropylcarbinol-α-C^{14} with $ZnCl_2$-HCl, treatment of ethylamine-1-C^{14} with HNO_2 and NaOI, and hydrolysis of 2- butyl-1-C^{14} p-toluenesulfonate are presented briefly. The fact that 2-methylbutane-1-C^{14} and iodobenzene-I^{131} have been synthesized is mentioned, and brief statements of progress on studies of orientation in aromatic substitution and hydrogen-isotope effect on acid-catalyzed reactions are given.

TRANSURANIC ELEMENTS AND COMPOUNDS

4125

Radiation Lab., Univ. of California
FIRST ISOLATION OF CURIUM. L. B. Werner and I. Perlman. Feb. 9, 1951. Decl. May 22, 1951. 16p. (AECD-3155; UCRL-156(2d.Rev.))

The first isolation of Cm in μg quantity from neutron irradiated Am is described. The Am and Cm were separated by the use of an ion-exchange resin and the Cm was further purified and isolated as the fluoride and hydroxide. The absorption spectrum of Cm(III) was measured and attempts were made to determine the specific activity of a sample of Cm_2O_3 weighing about 40 μg. 15 references. (auth)

4126

Radiation Lab., Univ. of California
THE PREPARATION AND SOME PROPERTIES OF AMERICIUM METAL. Edgar F. Westrum, Jr., and LeRoy Eyring. Mar. 13, 1951. 13p. (UCRL-1055)

AmF_3 prepared by hydrofluorination of the dioxide was reduced to metal on the 40- to 200-μg scale by reduction with Ba metal in a high-vacuum microfurnace at 1100°C in various refractory materials. High yields of silvery, very malleable and ductile metal globules were obtained. Reaction with H to form a hydride and measurement of H evolution upon dissolution in acid were further proof of the metallic state. The density was determined to be 11.7 ± 0.3 g/cc. Its low value compared to that of its preceding elementary neighbors is in striking resemblance to the behavior of its lanthanide analog, Eu. The heat of solution of the metal in 1.5M aqueous HCl was determined as −160 ± 4 kcal/mole. (auth)

4127

Radiation Lab., Univ. of California
THE MELTING POINT AND THE DENSITY OF NEPTUNIUM METAL; A MICRO MELTING POINT APPARATUS FOR METALS. Edgar F. Westrum, Jr., and LeRoy Eyring. Dec. 22, 1950. 9p. (UCRL-1056)

Np metal was prepared on the mg scale by reduction of NpF_3 with Ba. The melting point was determined as 640 ± 1°C; the density was found to be 19.5 ± 0.5 g/cc. An apparatus designed for the measurement of the melting points of 10 to 1000 mg samples of metals is described. (auth)

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

4128

ON THE ENERGETIC TREATMENT OF NON-ISOTHERMAL PROCESSES. THE PRINCIPLE OF THERMAL INTERACTION. Hans Holtan, Jr. J. Chem. Phys. 19, 519-25(1951) May.

The existing theories for nonisothermal processes are discussed. They can be divided into two kinds, depending on whether they take the flow of heat into account. None are able to predict experimental results. A new hypothesis, "the principle of thermal interaction," is introduced by employing Onsager's principle of reciprocity and is expressed in terms of Bronsted's energetics. It states that there is an interaction between the flow of heat and the transport phenomena in a nonisothermal process in such a way that the loss of work (loss of potential energy) for the transport of entropy bound to chemical substance can be compensated partly or completely by the transport of free entropy contained in the flow of heat in the opposite direction. The result is that any particle will tend to move against the temperature gradient. The new principle is applied to thermocells with a solid electrolyte, and the results predicted are shown to be in agreement with experimental data. The Knudsen equation, applicable to a thermal transpiration cell, is derived without employing the kinetic theory of gases. (auth)

4129

THE TRANSPORT PROPERTIES OF GASES ACCORDING TO THE SQUARE-WELL INTERMOLECULAR POTENTIAL. Eugene Martin Holleran. Thesis (Ph.D), Catholic University of America, 1949.

The collision integrals of the Enskog-Chapman kinetic theory have been evaluated on the basis of a square-well molecular potential. The model's parameters have been determined for A, He, Ne, CH_4, H_2, CO, O_2, N_2, and air. Using these parameters, the author obtained a satisfactory reproduction of the experimental data over a wide range for the viscosity of all these pure gases except H_2. The viscosity data for several binary mixtures also were reproduced satisfactorily after the introduction of an empirical formula for mixture viscosity. The viscosity parameters could not account adequately for most of the diffusion data, and the data were not extensive enough to determine new parameters for diffusion. Stier's data (Phys. Rev. 62, 548 (1942)) on the temperature dependence of R_T, the ratio of the thermal diffusion constant, α, of isotopes (hard-sphere model) to α_h (square-well model), for Ne were reproduced by using parameters different from these found from viscosity, but the data on argon could not be explained satisfactorily. Some conclusions are drawn about the qualitative temperature dependence of R_T.

MATERIALS TESTING

4130

Knolls Atomic Power Lab.
THERMAL STRESSES IN PERFORATED PLATES. G. Horvay. June 1951. 41p. (KAPL-P-456(rev.))

A slight revision has been made in the original report which was indexed as report KAPL-P-456 and appeared in Nuclear Science Abstracts as NSA 5-2777. Essentially the contents are the same as the earlier report.

4131

North American Aviation, Inc.
THE BEHAVIOR OF GRAPHITE UNDER ALTERNATING STRESS. L. Green. May 4, 1951. 18p. (NAA-SR-115)

The fatigue properties of grade AUF graphite were investigated at ambient and elevated temperatures. Specimens cut parallel to the axis of extrusion were stressed in reversed bending at room temperature and at 3550°F. The endurance limit of this graphite was found to increase from about 2500 psi at room temperature to about 4400 psi at 3550°F. The increase in endurance limit with temperature is correlative with the increase in short-time tensile strength with temperature observed in earlier studies of graphite. (auth)

4132

Engineering Research Inst. Univ. of Michigan
A FEASIBILITY STUDY FOR A LARGE SHOCK TUBE FOR BLAST-EFFECT DETERMINATIONS. (Report 51-1). Russell E. Duff and Robert E. Hollyer, Jr. Jan. 10, 1951. 21p. (NP-3059)

The problem of designing and constructing a shock tube suitable for blast-effect determinations and large enough to accommodate at least ¼-scale models is discussed. Various methods for producing the shock wave are considered. The most promising method appears to be the detonation of a wall of solid explosive at the back of the tube. No diaphragm of any kind would be required. General specifications for a large shock tube are discussed.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

4133

Massachusetts Inst. of Tech. Dept. of Metallurgy
TENTH INFORMAL MONTHLY REPORT ON DEVELOPMENT OF METAL-CERAMIC COMPOSITIONS SUITABLE FOR SERVICE AT ELEVATED TEMPERATURES. W. D. Kingery, G. Economos, M. Humenik, Jr., and M. Berg. May 1950. 6p. (NEPA-1449)

In the study of metal-ceramic wettability, contact angles have been determined for Bi on Mo silicide, Ni on graphite, and Be on alumina. Approximate calculations of surface tension for the metals considered have been made. Firing of Ti, Si, Zr, Mo, Nb, and Ni to 1825°C in contact with alumina and stabilized zirconia has been completed with preliminary observations. Certain free energies of oxidation-reduction for these metals and oxides have been calculated from thermodynamic data. The preliminary study of sintering of NaCl and NaCl-metal combinations has been continued using powder compacts in place of pressed disks. (auth)

METALS AND METALLURGY

4134

[Bureau of Mines]
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; MONTHLY REPORT FOR JANUARY 1951. L. B. Golden, I. R. Lane, Jr., E. V. Rhoderick, J. T. Pons, W. Mace, and W. R. Acherman. [nd] 9p. (AECU-1290)

Tabular results are given of corrosion studies of Ti, Zr, and stainless steel in 60 and 100°C solutions of aerated 1 and 10% NH_4Cl; Ti in aerated 5 and 20% Na_3PO_4 and in aerated 4% $Ca(ClO)_2$ at 60°C; Ti and Pb in 60 to 70% H_2SO_4 plus 1% HNO_3 at 1000°C; Mg, Zn, Al, Pb, Sn, Ni, and Cu coupled and uncoupled with Ti in substitute ocean water, 1% HCl, and 1% NaOH. Zr alloys tested in 95% ethyl alcohol at room temperature showed no corrosion effects except for slight gains or losses in weight.

4135

[Bureau of Mines]
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; MONTHLY REPORT FOR APRIL 1951. L. B. Golden, I. R. Lane, Jr., J. T. Pons, W. Mace, and W. R. Acherman. [nd] 10p. (AECU-1291)

Corrosion results are tabulated from studies of: Zr alloys in concentrated (37%) HCl at 60 and 100°C sealed in glass tubes, in mixed acid (84% HNO_3 plus 14% H_2SO_4); Zr-Ti alloys in aerated 5 to 20% and in nonaerated 37.5% HCl solutions; Zr-Ti alloys in 10 and 20% H_2SO_4 solution; and coupled and uncoupled samples of Mg and Ti in nonaerated and air-aerated substitute ocean water. Results of corrosion tests of Ti, Zr, stainless steel, and monel metal in boiling substitute ocean water are described briefly.

4136

Carnegie Inst. of Tech.
PROGRESS REPORT FOR MARCH 1951. Carl Moore, D. S. McKinney, and J. C. Warner. [nd] 18p. (NYO-547)

Experimental observations during the cathodic runs of Ti and Zr have indicated that the metal undergoes a change. Ti and Zr specimens were made cathode in 2.06N H_2SO_4 at 150 ma/cm² for 48 hr. The results of x-ray analysis of the specimen showed that for the Ti, TiH_2 was present. Zr showed lines for both ZrH and ZrH_2. Further proof for the existence of the hydride film was obtained by microscopic examination of a hydrided specimen after etching. The equilibrium concentration of Zn and H ions at 30°C has been determined for the aqueous phase of the system ZnO-H_2O. The experimental data is tabulated and shown graphically.

4137

Massachusetts Inst. of Tech.
THERMODYNAMICS OF METAL SOLUTIONS. John Chipman and George Scatchard. May 18, 1951. 5p. (NYO-916)

A brief description is given of a calorimeter designed for measuring heats of solution of metals. Preliminary runs have been made with this equipment in which the heat of solution of Ag in Sn at 240°C was measured. Thermodynamic quantities of ionic and oxide melts are considered briefly.

4138

CALCULATIONS OF SURFACE ENERGY FOR A FREE-ELECTRON METAL. H. B. Huntington. Phys. Rev. 81, 1035-9(1951) Mar. 15.

The surface energy of a free-electron metal is calculated using a square-cut barrier placed so that there is no net charge on the surface. The result is nearly independent of barrier height but leads to a value for surface tension less than half that observed for most molten metals. For Na a self-consistent surface barrier, first developed by Bardeen, is also used in numerical computation of surface energy. The value so obtained is about half that resulting from the use of the square-cut barrier. Previous theoretical treatments of this problem have generally predicted surface energies larger than observed. The opposite result in this case appears to result from the requirement that the surface be maintained electrically neutral. (auth)

4139

Battelle Memorial Inst.
DEVELOPMENT OF MAGNESIUM-CERIUM FORGED ALLOYS FOR ELEVATED-TEMPERATURE SERVICE. K. Grube, R. Kaiser, L. W. Eastwood, C. M. Schwartz, and H. C. Cross. Mar. 1951. 91p. (NACA-TN-2325)

Detailed results are reported of an investigation of Mg-Ce forged alloys, which included (1) the development of improved alloys and (2) a fundamental study correlating alloy composition and structure with the resistance to creep.

The nominal composition of the recommended alloy is 1.7% Mn, 2% Ce, 0.25% Ni, and the balance Mg.

4140

Lewis Flight Propulsion Lab.
SOME PROPERTIES OF HIGH-PURITY SINTERED WROUGHT MOLYBDENUM METAL AT TEMPERATURES UP TO 2400°F. R. A. Long, K. C. Dike, and H. R. Bear. Mar. 1951. 75p. (NACA-TN-2319)

High-purity, sintered, wrought Mo metal was investigated as to tensile-strength properties from 1800 to 2400°F and effects thereon of swaging, recrystallization, and "test-section" area. Additional studies were made on stress-rupture properties, types of fracture, directional properties of rolled plate, and metallography of swaged and recrystallized molybdenum.

MINERALS AND MINERALOGY

4141

ALLANITE FROM YOSEMITE NATIONAL PARK, TUOLUMNE CO., CALIFORNIA. C. Osborne Hutton. Am. Mineral. 36, 233-48(1951) Mar.-Apr.

Allanite-bearing rocks have been found in two localities in Yosemite National Park, viz., in narrow pegmatitic veins at Long Gulch, approximately 1 mile northeast from Aspen Valley, and in quartz-orthoclase pegmatite boulders in screes in the south slopes of Ragged Peak. Optical properties for these two occurrences are given. Both minerals are readily decomposed by warm concentrated HCl. Semi-quantitative tests show that the Long Gulch allanite contains approximately 0.6% MnO and 0.7% of ThO_2, whereas a complete quantitative analysis of the Ragged Peak mineral indicates that it contains 6.74, 2.02, and 0.95% of MnO, TiO_2, and ThO_2, respectively. Both minerals exhibit only slight evidence of metamictization, and neither contain Pb. Acid treatment of allanite is discussed, and it is shown that the degree of solubility is a function of composition and that true gelatinization will result only if the minerals are in a metamict condition.

4142

Mines Branch, Ottawa
ASSAY OF URANIUM-BEARING ORES BY FISSION ANALYSIS. (Topical Report No. TR-60/51) W. W. Happ and J. L. Horwood. Apr. 18, 1951. 27p. (NP-3099)

A method of "fission analysis" is proposed as a means of assaying radioactive ores. The procedure consists in determining the fissionable content of the ore by counting neutron-induced fissions. A series of preliminary tests have been carried out to determine techniques and instrumentation suitable for this analysis.

PHYSICS

4143

Brookhaven National Lab.
QUARTERLY PROGRESS REPORT; OCTOBER 1–DECEMBER 31, 1950. Mar. 1951. 129p. (BNL-93)

Separate abstracts have been prepared on the following sections of this report: Physics Department, p.1-32; Instrumentation and Health Physics Department, p.33-41; Accelerator Project, p.42-8; Chemistry Department, p.49-108; Reactor Science and Engineering Department, p.108-114; and Biology Department, p.115-24.

4144

Brookhaven National Lab.
REACTOR SCIENCE AND ENGINEERING DEPARTMENT, p.108-114 of QUARTERLY PROGRESS REPORT; OCTOBER 1–DECEMBER 31, 1950. Mar. 1951. 7p. (BNL-93(p.108-114))

Brief summaries of studies on reactor physics, I^{132} production, permanent disposal of radioactive wastes, waste concentration, meteorology, and local geology are presented.

4145

Tennessee Univ.
FIRST QUARTERLY REPORT ON ENERGY CHANGES RESULTING FROM PLASTIC DEFORMATION. E. E. Stansbury. Feb. 1951. 10p. (ORO-28)

Experimental methods and apparatus to be used in the investigation of changes in internal energy resulting from plastic deformation are discussed briefly.

4146

Radiation Lab., Univ. of California
CLASSICAL ELECTRICITY AND MAGNETISM. W. K. H. Panofsky. Nov. 1950. 349p. (UCRL-1014(4th rev. ed.))

The first part of this course deals with the derivation of Maxwell's equations from the fundamental experimental laws of Coulomb, Ampere, and Faraday. The second part deals with problems associated with the theory of the electron. The problems are treated entirely classically with special emphasis, however, as to the features and particularly the difficulties which have a more general significance. The special theory of relativity is treated more thoroughly than is customary in a course in electricity, and in particular its experimental basis is discussed. Chapters on covariant formulations of vacuum electrodynamics, of the electromagnetic field equations in material media, and of the conservation laws of electrodynamics, and on Hamiltonian formulation of Maxwell's equations conclude this 34-chapter volume.

4147

Naval Research Lab.
ELECTRON EMISSION FROM THIN FILMS OF DIELECTRIC

UNDER THE INFLUENCE OF BOMBARDMENT BY POSITIVE IONS; trans. from Zhur. Eksptl'. i Teoret. Fiz. 19, 297-9(1949). S. V. Starodubtsev. 1950. 5p. (NRL-Trans-317)

This report is a translation from the Russian of the original article which was abstracted in Nuclear Science Abstracts as NSA 3-1730.

4148

MEASUREMENT OF THE VAPOR TENSION OVER SOLUTIONS OF He-3 IN He-4; trans. from Zhur. Eksptl'. i Teoret. Fiz. 20, 1055-6(1950). B. N. Yesel'son, B. G. Lazarev, and N. Ye. Alekseyevskiy. 1950. 3p. (NP-2291; U-1289)

Brief note is made of results of experiments which verify the applicability of Raoult's law to studies of the properties of solutions of He^3 in He^4. Data obtained from measurement of vapor tension over solutions of He^3 in He^4 are tabulated. 7 references.

4149

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. Jan. 1, 1951. 63p. (NP-1857)

Separate abstracts have been prepared on the following sections of this report: Chemistry of the Fission Elements Group, sect. 1; Cosmic Ray Group, sect. 2; Elementary Particle Scattering Group, sect. 3; 12-Mev Generator Construction and Hign Voltage Research Group, sect. 4; Nuclear Chemistry (Inorganic) Group, sect. 5; Nuclear Chemistry (Organic) Group, sect. 6; Nuclear Cross Sections Group, sect, 7; Radioactivity and Cyclotron Group, sect. 8; Synchrotron Group, sect. 9; and Theoretical Group, sect. 10.

4150

THEORY OF SUPERFLUIDITY AND CRITICAL VELOCITY IN HELIUM II; trans. from Doklady Akad. Nauk 69, 161 (1949). V. L. Ginsburg. 1949. 9p. (NP-2308; AECtr-204)

The value of the critical velocity for superfluid motion of He(II) and its dependence on the slit width and temperature have been considered. 15 references.

4151

Vibration Research Lab., Stanford Univ.
TRANSVERSE VIBRATION OF ONE- AND OF TWO-SPAN BEAMS UNDER THE ACTION OF A MOVING COMBINED LOAD CONSISTING OF A SPRING-BORNE MASS AND AN ALTERNATING FORCE. (Technical Report No. 12) Mar. 31, 1951. 53p. (NP-3090)

Consideration of the dynamic effects of traveling loads on continuous beams and bridges.

ASTROPHYSICS

4152

THE HEAVY CARBON ISOTOPE IN STELLAR ATMOSPHERES. P. P. Dobronravin. Priroda, 3-8(1950) Oct. (In Russian)

Unlike atomic spectra, where isotopic effects are reflected in wavelength differences of a few thousandths of an angstrom, molecular spectra indicate distinctions between isotopes by differences of the order of 10 A, owing to notable changes in the moment of inertia of the molecule which affect accordingly the energy of the molecule's vibrations and rotations. This situation is utilized in astrophysics for the discovery of isotopes in stellar atmospheres. A review is presented of a work published by Shaĭn and Gaze (Izvest. Krymskoĭ Astrofiz. Observ. Akad. Nauk S.S.S.R. 2, 51, 131(1948)) on spectra of "carbon stars" of the stellar classes R and N, in which bands could be assigned to molecules of C_2 and CN in isotopic combinations $C^{12}C^{12}$, $C^{12}C^{13}$, $C^{13}C^{13}$, $C^{12}N$, and $C^{13}N$. The main outcome of the work was the discovery (by using differences in the bands' intensities) of very variable relative isotope abundances in different stars, viz., C^{13}/C^{12} = ½ to 1/90, greatly differing from the ratio 1 to 100 on earth. It can be calculated that isotopic differences in the catalytic carbon influence the lifetimes of the several steps in the formation of He from H in the sun, and that this reaction is stationary only if the ratio C^{13}/C^{12} is about 1/90, i.e., close to that on earth. The notable deviations from this value observed on carbon stars point either to a young age for these still cool stars, where the H → He process has not yet become strong and stationary, or to some other nuclear processes of energy production at work in these stars.

COSMIC RADIATION

4153

BAROMETRIC AND TEMPERATURE COEFFICIENTS OF FREQUENCY OF SMALL COSMIC-RAY BURSTS AND OF BURST-CORRECTED COSMIC-RAY IONIZATION. James W. Broxon. Phys. Rev. 81, 555-64(1951) Feb. 15.

Barometric and (surface) temperature coefficients are determined for a class of cosmic-ray bursts consisting of 1.2 to 1.9 × 10^6 ion pairs in argon at 20 atm in a heavily shielded chamber, as well as for the burst-corrected ionization. For the bursts the coefficients are found to depend on whether the multiple regression coefficient and partial correlation coefficient are computed from daily averages for individual months or for the total of 581 days, the latter yielding a positive temperature coefficient of 0.24%/°C. For the bursts, the averages of the coefficients for 19 individual months are −1.54%/mm Hg and −0.98%/°C, whereas the averages for those months with significance ratios above the 2% level are −2.44%/mm Hg and −1.66%/°C. For the burst-corrected ionization, the averages of the coefficients for 19 individual months are −0.154%/mm Hg and −0.038%/°C, whereas the values computed for 581 days are −0.174%/mm Hg and −0.056%/°C. Little differences from the latter values are found with computations based on monthly means. Comparisons are made with earlier observations with the same chamber containing air at 160 atm and with the observations of other experimenters, and the

relations of these to the explanation of the temperature dependence in terms of meson decay developed by Blackett (Phys. Rev. 54, 973(1938)) and Duperier (Proc. Phys. Soc. (London) 61A, 34(1948)) are discussed. Values for the mean free paths of the radiations producing the small bursts and the burst-corrected ionization are deduced on the basis of their respective barometric coefficients. (auth)

4154

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
COSMIC RAY GROUP, sect. 2 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. Bruno Rossi and G. E. Valley. Jan. 1, 1951. 4p. (NP-1857(sect.2))

Brief statements, containing no appreciable scientific data, on the status of the east-west effect, synchrotron studies, balloon-borne hard-component experiment, Echo Lake cloud chamber and ionization chamber, mean free path of high-energy neutrons in Pb and C, and scintillation counters are presented. A photograph of an event consistent with the decay of a particle of mass ~900 m_e into a π meson is shown.

4155

EMISSION OF ENERGETIC HELIUM AND LITHIUM FRAGMENTS IN NUCLEAR EXPLOSIONS. S. O. C. Sörensen. Phil. Mag. (7) 42, 188-201(1951) Feb.

A phenomenological description is given of the processes which lead to the emission of energetic heavy particles from cosmic-ray stars. The frequency, angular distributions, and energy spectra of the particles have been determined. These, and an analysis of the associated stars, indicate that the particles cannot be generated by an evaporation process. On the other hand, direct knocking on of the heavy particle by the primary can be excluded. The fragments must, therefore, result from interactions which are intermediate between these two extreme possibilities. No connection has been found between the ejection of energetic heavy particles and meson showers. 18 references. (auth)

4156

THE EXISTENCE OF PHOTONS UNDER 26 CMS. Pb IN COSMIC RAY AIR SHOWERS. Frank L. Hereford. Virginia J. Sci. (New series) 1, 338-9(1950) Sept.

The article has been reproduced here in its entirety.

Recent data (Phys. Rev. 75, 1324(1949)) indicate that the frequency under 15 cm of Pb of small cascade showers associated with large cosmic-ray air showers is in excess of that expected from the known intensity of penetrating μ mesons in air showers. On the basis of absorption data several workers (Compt. rend. 226, 169(1948)) have proposed the existence in air showers of a penetrating lighter meson (about 10 m_e) which could provide a mechanism for local production of these cascades. Although this interpretation has since been soundly discredited (Phys. Rev. 75, 1063(1949)) further pertinent data are of interest. Accordingly the detection of photons proceeding from this local cascade production has been attempted under a Pb thickness exceeding the maximum penetration depth of cascade showers preexisting in air (20 cm of Pb). Through modification of a previously described apparatus (Phys. Rev. 76, 142(1949)), a tray of G-M counters shielded by an anticoincidence tray was operated under 26 cm of Pb in coincidence with an unshielded counter system sensitive to large air showers. The insertion of a 3-mm Pb sheet between the trays under the thick Pb shield should enhance the photon efficiency of the lower tray through provision of material in excess of the counter walls for production of pairs and Compton recoil electrons. Coincidences were recorded over a 4-month period beneath a ¾-in. wood roof with such a 3-mm Pb sheet alternately in and out of position between the trays. No change in the coincidence rate greater than the statistical error was observed, indicating the absence of an appreciable photon intensity.

4157

THE EXISTENCE OF A SECONDARY MAXIMUM IN THE TRANSITION CURVE OF PHOTOELECTRONIC SHOWERS. Roland Maze and Tsai-Chü. Compt. rend. 232, 224-6(1951) Jan. 15. (In French)

Prolongation of the cascade by photons of 1 to 10 Mev has been investigated with two crossed banks of 12 quadruple-coincidence counters detecting pairs of particles originating in the transition material, Pb, and having an angular deviation of 4°. A second maximum in the transition curve was found for a 6-cm thickness of Pb. This maximum disappeared when 6 mm of Al was placed above the counter banks or when 4 mm of Pb was placed between them, owing to production of knock-on electrons or absorption, respectively.

4158

IONIZATION CHAMBER BURSTS AT HIGH ALTITUDES. Thomas Coor, Jr. Phys. Rev. 82, 478-85(1951) May 15.

A thin-walled, low-pressure ionization chamber has been sent into the upper atmosphere by means of balloons to study bursts of ionization. Pulse size, barometric pressure, and temperature were telemetered to the ground. Measurements have been made of the size and frequency of bursts of ionization greater than that produced by 0.8 Po α particles (0.8 × 5.1 = 4.1 Mev) at altitudes up to that corresponding to an air mass of 17 g/cm² remaining overhead. The abnormally large bursts observed at the highest altitudes receive a reasonable explanation in terms of the heavy-nucleus component of the primary radiation. The heavy nuclei which are responsible for the anomalous distribution of pulse sizes near the top of the atmosphere produce ~12% of the observed bursts. The total ionization due to nuclear fragments is determined as a function of altitude and extrapolates to 3200 ev/cm³ of A (0°C, 76 cm Hg)/sec at zero pressure.

4159

NEUTRON PRODUCTION BY COSMIC RAYS AT SEA LEVEL. A. R. Tobey and C. G. Montgomery. Phys. Rev. 81, 517-19(1951) Feb. 15.

Neutrons produced by the cosmic radiation at sea level in paraffin, Al, and Pb have been measured in a boron-filled ionization chamber provided with boron guard rings. Proper application of the diffusion theory of slow neutrons was

possible, and absolute values of the rate of production of neutrons per gram per second were obtained. (auth)

4160

A NOTE ON THE V PARTICLE. C. B. A. McCusker and D. D. Millar. Nuovo cimento 8, 1-3(1951) Apr.

Two cloud-chamber photographs, taken during an experiment on local penetrating showers of cosmic radiation and reproduced as stereoscopic pairs, indicate that heavy neutral particles can be produced in groups in a single nucleon-nucleus encounter and that the decay in at least some cases is a decay into two particles only.

4161

ON SUBSURFACE LOCAL PENETRATING EFFECTS. Roland Maze. Compt. rend. 231, 1295-7(1950) Dec. 6. (In French)

Results of coincidence studies at the surface and at 30-m depth, where only mesons and their secondary products are found, confirm the relative increase with depth of knock-on electrons with respect to mesons and show the existence of multiple penetrating effects inexplicable with respect to these same electrons. The existence of a secondary nuclear component of ordinary mesons below the surface is concluded; the horizontal component is explained as due to anomalous collisions of vertical mesons giving rise to nucleons and new mesons, as discussed by George (Nature 164, 838(1949)).

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4162

ABSORPTION EDGES ON DEBYE-SCHERRER X-RAY PHOTOGRAPHS. R. Brooks. Brit. J. Applied Phys. 2, 76-7(1951) Mar.

On powder photographs taken with Kα radiation obtained by filtering x rays from a pure metal target through the appropriate "β filter," sharp-edged bands which are not normal powder lines may occur in the low-angle region. These are shown to be due to residual x rays of short wavelength which give rise to dark bands where fluorescence of Ag and Br occurs in the photographic emulsion. It is concluded that in the analysis of mixtures it should be borne in mind that bands of this sort accompany all strong Kα reflections from the specimen, and they should be carefully distinguished from weak Kα reflections. (auth)

ELECTRICAL DISCHARGE

4163

Utah Univ.
INDUCTION OF CHEMICAL REACTIONS BY HIGH-FREQUENCY DISCHARGES IN GASES; PROGRESS REPORT AS OF NOVEMBER 1, 1950. Bruno J. Zwolinski and Ransom B. Parlin. [nd] 18p. (AECU-1296)

An investigation has been made of the endothermic combination of N and O brought about by discharges from a variable high-frequency oscillator. Under controlled conditions, the effect of pressure, gas flow, discharge frequency, power, and electrode gap distance on the formation of oxides of N in dry, CO_2-free air subjected to a discharge in the frequency range of 1.5 to 10.5 Mc have been determined. Various reaction mechanisms are discussed as a means of explaining the formation of nitric oxides in both direct current and high frequency discharges. Apparatus and experimental procedure to be used in an investigation of the formation of hydrazine from ammonia through the use of high-frequency discharges are discussed. 10 references.

GASES

4164

Illinois Univ.
TRANSPORT PHENOMENA IN DENSE MEDIA; II. THERMAL DIFFUSION IN COMPRESSED GASES. W. L. Robb and H. G. Drickamer. [nd] 11p. (AECU-1326)

From the thermodynamics of irreversible processes, values of the thermal-diffusion ratio α have been calculated using (1) the virial equation of state, (2) generalized reduced enthalpies, and (3) the Lennard-Jones and Devonshire (LJD) "cage" model for liquids. These results are compared with experiment and with previously published calculations for a van der Waals' gas. Only the LJD model gave results markedly superior to van der Waals' equation. The LJD model predicts very large positive values of α for compressed pressed liquids. (auth)

4165

AN INTERFEROMETRIC METHOD OF DETERMINING DIFFUSION COEFFICIENTS IN GASEOUS SYSTEMS. Charles A. Body, Norman Stein, Virginia Steingrimsson, and William F. Rumpel. J. Chem. Phys. 19, 548-53(1951) May.

A new type of experimental method for accurately measuring diffusion coefficients in gaseous systems is described. The change of composition in the diffusion cell is followed by measuring the change in refractive index with an interferometer. Results obtained using this method compare favorably with some values reported in the earlier literature. In addition, values are reported for new systems not studied previously. A comparison is made between measured values and those calculated from viscosity data. (auth)

4166

MOBILITY IN A SORBED LAYER. PART I. THE FLOW OF GASES AND VAPOURS THROUGH POROUS MEDIA. W. Mervyn Jones. Trans. Faraday Soc. 47, 381-92(1951) Apr.

Theoretical equations are derived for the surface flow of an ideal two-dimensional gas through (a) a hole in a plane sheet, (b) a long circular capillary, and (c) a porous material, the porous material being treated as a bundle of capillaries. The equations express the flow in terms of the dimensions of the capillaries, the concentration of surface molecules at the ends of the capillaries, the molecular weight of the gas, and the temperature. The surface flow is not affected by the presence of the vapor phase in the capillaries nor by the roughness of the surface, provided the end conditions and the dimensions of the capillaries remain unaltered. The equations will explain the results of Tomlinson and Flood on the flow of ether and ethyl chloride through porous graphite, when the conditions of the experiment are

such that nearly a monolayer is sorbed on the graphite. At lower surface concentrations the effect of surface field must be taken into account; this is discussed. The results of Carman on the flow of SO_2 through porous silica are also discussed and, here, the surface field appears to restrict surface mobility for all concentrations examined. It is concluded that in addition to the expressions for Poiseuille flow and Knudsen flow, which occur in equations for the flow of gases and vapors through fine capillaries, a third expression must be included, namely, that for the flow of sorbed molecules over the surface of the capillaries. (auth)

INSTRUMENTS

4167

Argonne National Lab.
WIDE RANGE, CONTINUOUSLY VARIABLE HIGH CURRENT GENERATOR CONTROL. Jay R. Wolff and Melvin S. Freedman. Mar. 2, 1951. 14p. (AECU-1252; UAC-361)

A circuit is described for controlling the output current of a high-current (100 amp) d-c generator driving a low-impedance (2.5 ohm, 40 mh) load. The circuit features precise continuous control of the load current by a single-dial potentiometer over the range from zero to full output, with 0.04% linearity of current vs. potentiometer setting. A method is presented for reduction of current ripple from the generator in the low-impedance load. (auth)

4168

Los Alamos Scientific Lab.
A DEVICE FOR RAPIDLY FITTING DATA TO TWO MASS LAW DISSOCIATION CURVES APPLIED TO ENZYME REACTIONS. Jean C. Sabine. [nd] 28p. (AECU-1346; LADC-965)

An apparatus, simple in use for anyone familiar with the principles of logarithms, somewhat like a specialized, two-dimensional slide rule, was developed for repeated, rapid fitting of data to theoretical curves. As presented, the method is adapted for use with 2 equations, rearrangements of simple dissociation expressions, applied to the kinetics of enzyme reactions, $v = [V(S)]/[(S) + K_s]$ (Michaelis and Menten) and $v = [V(S)]/[(S) + K_s + (S)^2/K_s]$ (Haldane), specifically for the use with the two major types of cholinesterase, to evaluate the limiting velocity and the apparent dissociation constants. There are numerous other applications of the method, which is shown to be reliable and accurate. The apparatus consists of a sheet of lucite for plotting, a specially prepared sheet of log-log graph paper, and a "master chart" providing the means of determining the experimental values for the data plotted for each equation.

4169

Brookhaven National Lab.
INSTRUMENTATION AND HEALTH PHYSICS DEPARTMENT, p.33-41 of QUARTERLY PROGRESS REPORT; OCTOBER 1–DECEMBER 31, 1950. Mar. 1951. 9p. (BNL-93(p.33-41))

Circuit diagrams of a nonoverload amplifier, an expander amplifier, and an anticoincidence circuit for pulse-height analysis are shown. Radiation surveys of the buildings and area, personnel monitoring, and results of a study on the urinary excretion of Sr^{90} are summarized.

4170

Los Alamos Scientific Lab.
COINCIDENCE AMPLIFIER. John Buchen. Nov. 28, 1950. 10p. (LA-1208)

The CA-1 Coincidence Amplifier has been designed for use in conjuction with two atomic linear amplifiers and three SC-3 binary scalers for the determination of radioactive-decay schemes. The measured resolving time of the system is 0.42 μsec and its dead time is that of the scaler, or 8 μsec. Design details are shown.

4171

Los Alamos Scientific Lab.
SERVO-CONTROLLED INTERCOMMUNICATION SYSTEM. John Buchen and Verner Rexroth. July 1, 1950. 21p. (LA-1212)

A detailed description is made, supplemented by circuit diagrams and photographs, of an intercommunication system unique in its design and operation in that there is but one audio amplifier required for a system in which all stations are masters.

4172

Los Alamos Scientific Lab.
POWER SUPPLY. John Buchen. Nov. 28, 1950. 9p. (LA-1252)

The PS-7 Power Supply is a variable voltage, variable output current, unit designed for use as a power source for a cathode discharge tube used in spectrographic studies. The output voltage is continuously variable over a range of 0 to 1000 v at any output current from 0.020 to 1 amp. The operation and design of this power supply are described in detail.

4173

ABERRATIONS OF IONIC LENSES IN ION SOURCES. Francois Bertein. Compt. rend. 231, 1448-9(1950) Dec. 18. (In French)

Focusing of an ionic beam by a slit when the beam occupies an appreciable part of the slit or even the entire aperture, giving rise to an "aperture aberration," has been studied. A formula is given for the angle of deviation when the slit acts as a weak lens, i.e., when the slit is relatively narrow compared with the focal length, and is in an infinitely thin diaphragm.

4174

Research Lab. of Electronics, Mass. Inst. of Tech.
AMPLITUDE MODULATION OF SYNCHRONIZED MICROWAVE OSCILLATORS. (Technical Report No. 166) W. P. Schneider and E. E. David, Jr. July 25, 1950. 24p. (NP-3079)

It is shown that two push-pull f-m oscillators, both synchronized by the same r-f signal, can be arranged so that their combined output contains the side bands of ordi-

nary amplitude modulation. Linearity of the scheme is excellent even for high modulation indices. The bandwidth is somewhat less than the a-m bandwidth of the oscillators themselves; it is about 3 Mc at X band. Experimental work with the system indicates that it has characteristics suitable for microwave relay and possibly low-power broadcast applications. (auth)

4175

Research Lab. of Electronics, Mass. Inst. of Tech.
CORRELATOR ERRORS DUE TO FINITE OBSERVATION INTERVALS. (Technical Report No. 191) Wilbur B. Davenport, Jr. Mar. 8, 1951. 17p. (NP-3080)

A measurement signal-to-noise ratio is defined as the reciprocal of a normalized rms measurement error. This ratio is evaluated for the general continuous correlator and for the general sampling correlator. The limiting behavior of the signal-to-noise ratio is studied for several specific cases. The continuous correlator cases considered are those where the averaging filter is (a) a perfect integrator, and (b) an RC low-pass filter. The sampling correlator special case considered is that where the sampling is done periodically. (auth)

4176

Southern California Univ.
FURTHER EXPERIMENTS ON THE KINGDON CAGE. (Technical Report No. 4) Nathan Wainfan and G. L. Weissler. Mar. 1951. 17p. (NP-3093)

A series of experiments is described in some detail wherein an attempt has been made to detect single ionization events using the positive-ion detector. The ion detector used is in essence a cylindrical diode with a screen at each end. In an investigation of the current fluctuations through the positive-ion detector, pulses were observed which were believed to be produced by positive ions. Experiments were carried out using an ion gun to inject ions into the detector, using the detector in a simple bridge circuit, and using an ion emitting Pt filament inserted parallel to the coaxial electron-emitting filament. Sinusoidal oscillations have been observed in the detector under certain filament and voltage conditions.

4177

Commissariat á l'Énergie Atomique
LOGARITHMIC AMPLIFICATION OF WEAK CURRENTS WITH THE AID OF DIODES; extract from J. phys. radium 12, 144-6(1951). (In French) M. Brière, A. Rogozinski, and J. Weill. Feb. 1951. 2p. (CEA-72)

The logarithmic dependence of the anode potential of a diode tube on its thermionic-current intensity was studied in the demain of very weak currents, using as a source either a photoelectric cell or an ionization chamber irradiated with γ or x rays. The logarithmic law was found to be valid, within certain limits, for low-intensity currents. The circuit used, comprising an electrometer tube, can be employed for detection and measurement of feeble photon beams and corpuscular radiations.

4178

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
12-MEV GENERATOR CONSTRUCTION AND HIGH VOLTAGE RESEARCH GROUP, sect. 4 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. J. G. Trump. Jan. 1, 1951. 5p. (NP-1857(sect.4))

Status of construction of the 12-Mev positive-ion accelerator and installation of the 2-million-volt van de Graaff therapeutic x-ray generator is stated briefly. Measurements on the emission of electrons by Al, Au, graphite, and stainless steel when bombarded by 1.0- to 2.0-Mev electrons are presented in graphical form. Experiments in progress on methods of preventing emission of both positive ions and higher energy electrons from the anode, vacuum properties of acceleration-tube materials, gas absorbents, sterilizing effect of high-energy electrons, and 2-million-volt x-ray therapeutic techniques are mentioned.

4179

Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 12; IONIZATION CHAMBER INSULATING MATERIAL; APRIL 15–JULY 15, 1950; FOURTH QUARTERLY PROGRESS REPORT. F. A. Muller and H. G. Nordlin. [nd] 85p. (NP-3042)

Two products have been obtained from the reaction of acetophenone with hydrazine. One is a product melting at 124°C, and the other a product melting at about 121°C. Volume resistivity measurements were made on disks of polystyrene after conditioning in desiccated air. From the results of this test it appears that the effects of this treatment were masked by other variables. Details are shown of a guarded Hg electrode cell which is to be used for measurements of the surface resistivity of the polystyrene disks which have been designed and constructed. Provision is made for measurements at a controlled relative humidity. Initial measurements indicate that the surface resistivity is relatively independent of the period of application of the test voltage. Initial measurements of polystyrene disks irradiated by γ rays indicate that the residual effects of a 10^8 r dosage are not pronounced. A general bibliography consisting of 218 references on the effects of ionizing radiation on matter has been prepared, with particular reference to the suitability of various insulators for use in ion-chamber instruments.

4180

PASSIVE PULSE SHARPENING CIRCUITS. Leonard Reiffel. Rev. Sci. Instruments 22, 214-16(1951) Mar. (Laboratory and shop note)

A passive device, a diode-damping resonant circuit acting as a load for a G-M tube or similar pulse-generating detector, is described which will permit radical shortening of an output pulse without prohibitive amplitude losses. The circuit will produce pulses shorter than the actual burning time of the G-M tube and may be used with coincidence circuits whose resolving times are limited only by the introduction of false coincidence losses due to secondary-electron transit-time delays. The circuit is quantitatively compared with other pulse-sharpening techniques.

4181

National Bureau of Standards
REPORT OF THE OFFICE OF BASIC INSTRUMENTATION FOR THE QUARTER ENDING DECEMBER 31, 1950. W. A. Wildhack. Dec. 31, 1950. 17p. (NP-3000)

Objective, background, and progress of the following projects are reported briefly: spring transducer, pneumatic gas analyzer, interference optical microscope, mutual inductance transducer, vacuum-tube accelerometer, absolute measurement of vibration amplitudes, piezoelectric accelerometer, electron interferometer, pulsed photomultiplier, CO_2 hypsometer, mass spectrometer, microphonic study of microwave tubes, and cathode-ray oscillograph beam intensification.

4182

Research Lab. of Electronics, Mass. Inst. of Tech.
SIGNAL-TO-NOISE RATIO IN CORRELATION DETECTORS. (Technical Report No. 186) R. M. Fano. Feb. 19, 1951. 14p. (NP-3081)

The operation in the presence of noise of a correlation detector consisting of a multiplier followed by a low-pass filter is discussed. It is shown that in the most favorable cases the output signal-to-noise power ratio is proportional to the corresponding input ratio and to the ratio of the signal bandwidth to the bandwidth of the low-pass filter. (auth)

4183

Washington Univ.
TECHNICAL REPORT NO. 8; A MAGNET-COIL WINDING APPARATUS. O. Retzloff. Feb. 28, 1951. 9p. (NP-3065)

Design specifications are given of an apparatus for winding large pie-type coils of Cu strap insulated with strip fiber glass.

MASS SPECTROGRAPHY

4184

GAS FLOW THROUGH THE MASS SPECTROMETER VISCOUS LEAK. R. E. Halsted and Alfred O. Nier. Rev. Sci. Instruments 21, 1019-21(1950) Dec.

An approximate expression for the flow of a binary gas mixture through a mass spectrometer "viscous" leak has been derived and compared with experimental data. The factors important in the design and use of the leak are determined from this result. (auth)

4185

Commissariat á l'Ènergie Atomique
ON ION OPTICS OF MASS SPECTROMETERS WITH SIMPLE MAGNETIC DEFLECTION; extract from Compt. rend. 232, 615-617(1951). Charles Cassignol and Guy Nief. Feb. 12, 1951. 2p. (CEA-68)

The usual method of defining the resolution of a mass spectrometer is stated to be too pessimistic. Problems involved in calculating the geometric aberration of the beam are mentioned. An error, ϵ, in the boundary of the magnetic field is said to involve a transverse aberration of the order of ϵ (in light optics this would be $\sqrt{\epsilon f}$). It is thus sufficient to machine the pole pieces with the same precision as the source and collector.

MATHEMATICS

4186

Los Alamos Scientific Lab.
INTEGRAL DIFFUSION KERNEL FOR A CYLINDER. Foster Evans. Jan. 28, 1948. 23p. (AECD-3143; LADC-937)

Methods of integration of $\int_\tau q(P')K(|P', P|)d\tau$ are considered for the case in which the region τ is a cylinder, q is constant across the cylinder, and the kernel is

$$K(|P', P|) = \frac{e^{-|P', P|/\lambda}}{4\pi|P', P|^2}$$

Results of numerical integration are tabulated and presented graphically.

4187

Los Alamos Scientific Lab.
ON THE ACCURACY OF A PROCEDURE OCCURRING IN THE MONTE CARLO METHOD. Arnold Siegert. Jan. 7, 1948. 15p. (AECD-3159; LADC-948)

Assuming that after an actual run the numbers of original cards (representing source neutrons) belonging to class k ($k = 0 - - - K$) are observed to be n_k ($\sum_0^K n_k = n$)—the classification being made according to the number of descendants of given specifications—calculation has been made of the joint probability density for the probabilities ϕ_k that an original card will be of class k. From this joint probability density, the distributions of

$$n \sum_0^K \frac{(\phi_k - n_k/n)^2}{n_k/n} \quad \text{and} \quad \sum_0^K \alpha_k \phi_k$$

(α_k arbitrary) have been computed. The former indicates how well the actual probabilities ϕ_k are approximated by the numbers n_k/n; the latter can be used to obtain the probable error in the total number of descendants of given specifications. (auth)

4188

Kenyon Coll.
REMARKS ON THE LEBESGUE'S MEASURE EXTENSION DEVICE FOR FINITELY ADDITIVE BOOLEAN LATTICES. Otton Martin Nikodým. [nd] 9p. (AECU-1313)

A summary of this report has been issued and indexed as AECU-1331, which has been reproduced in its entirety in Nuclear Science Abstracts as NSA 5-4191.

4189

Kenyon Coll.
CRITICAL REMARKS ON SOME BASIC NOTIONS IN BOOLEAN LATTICES. Otton Martin Nikodým. [nd] 63p. (AECU-1314)

Some basic concepts in Boolean lattices (tribes) are clari fied and generalized. Ambiguities involved in the usual understanding of the notion of homomorphism and of the

subtribe of a given tribe are removed by careful consideration of the role of equality of elements of a tribe. For the infinite-operation homomorphism, four possible definitions are discussed, and three notions are isolated: weak, ordinary, and strong denumerable-operations homomorphisms. Several examples show their mutual relation. There are analogous definitions for all-operation homomorphisms. There are defined two kinds, weak and ordinary, of denumerably additive ideals in a tribe, and their properties are proved. The notion of a finitely genuine subtribe of a given tribe is defined. A great number of examples show the mutual relation of the notions introduced, and some general new theorems are proved. To the paper are added, for the sake of completeness, various examples showing different possibilities in the existence of a finitely additive and denumerably additive measure in finitely, denumerably additive and completely additive tribes.

4190

Kenyon Coll.
UNIVERSAL REAL LOCALLY CONVEX LINEAR TOPOLOGICAL SPACES. Otton Martin Nikodým. [nd] 26p. (AECU-1327)

It is known that every separable Fr. Riesz-Banach space can be isometrically and isomorphically embedded into the (C)_ space of all continuous functions in $\langle 0,1\rangle$ with norm $\|f\| = \max f(x)$. Recently E. Silverman has embedded the same spaces into the space (m), i.e., the space of all bounded infinite sequences with the norm $\|a\| = \sup_n |a_n|$ where $a = (a_1, a_2, \ldots)$. The present paper shows that the method used by Silverman can be generalized to fit the construction of universal spaces which embed the general locally convex real linear topological spaces. The obtained result discloses, at the same time, that essentially vectors of such a space can be conceived as some real-valued functions, and its topology as generated by a generalized uniform convergence. Thus the uniform convergence shows itself as a more general notion than could be surmised. (auth)

4191

Kenyon Coll.
REMARKS ON THE LEBESGUE'S MEASURE EXTENSION DEVICE FOR FINITELY ADDITIVE BOOLEAN LATTICES. (Summary of the Paper) Otton Martin Nikodým. [nd] 2p. (AECU-1331)

The report is reproduced here in its entirety.

The term "tribe" is used to denote Boolean lattices (Boolean fields, B. rings, B. algebras). Let (A), (A′) be two finitely additive tribes, where (A) is a finitely genuine subtribe of (A′) (see AECU-1314), and let $\mu(a)$ be a finite, nonnegative, finitely additive measure on (A). The following three devices of extending the measure μ from (A) into (A′) are examined: (1) Lebesgue's device by denumerable coverings of $a' \in A'$, $a' \leq {}'\sum_{n=1}^{\infty} {}' a_n$ where $a_n \in A$ and where primes refer to (A′); (2) a generalization of the classic Carathéodory's device known, e.g., from S. Saks's book, "Theory of the Integral"; (3) the author's own device studied in a particular case in the paper "Sur la mesure vectorielle" (Acad. roy. Belg. Classe sci. Mem. 17(1938)). If (A′) is denumerably additive, it is proved that all three devices give the same extension of measure into (A′), which in its properties is similar to the classic case of measure of sets. However, we get, for the exterior extended measure $\mu'_e(a)$ the inequality $\mu'_e(a) \leq \mu(a)$ for all $a \in A$, and there may hold the strong inequality. If (A′) is finitely additive only, the problem is solved through Mac Neille's embedding theorem. Some rather deep theorems on extended measure are proved.

4192

Kenyon Coll.
CRITICAL REMARKS ON SOME BASIC NOTIONS IN BOOLEAN LATTICES. (Summary of the Paper) Otton Martin Nikodým. [nd] 2p. (AECU-1332)

This report is a summary of report AECU-1314 and is included in that document. See abstract NSA 5-4189.

4193

Vibration Research Lab., Stanford Univ.
ON A GENERAL METHOD OF SOLVING SECOND ORDER DIFFERENTIAL EQUATIONS BY PHASE-PLANE-DISPLACEMENTS. (Technical Report No. 13) Lydik S. Jacobsen. [nd] 48p. (NP-3089)

The phase-plane-delta method of solving second-order differential equations has been illustrated by numerous examples involving graphical constructions. Test cases show good accuracy for practicable size of steps, but in general the degree of approximation can be inferred empirically only. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

4194

Los Alamos Scientific Lab.
ABSOLUTE MEASUREMENT OF ν_{25} WITH LONG COUNTER. T. Snyder. [nd] Decl. May 8, 1951. 3p. (AECD-3145; LADC-914)

The details of an arrangement are discussed whereby the number of fission neutrons produced by the irradiation of U^{235} with slow neutrons can be measured.

4195

Radiation Lab., Univ. of California
THE COUNTING EFFICIENCY OF Pa^{233}. D. G. Karraker. Feb. 27, 1951. Decl. May 22, 1951. 11p. (AECD-3154; UCRL-1147)

The counting efficiency of Pa^{233} has been determined by comparison of the counting rate of Pa^{233}, under stated conditions, with the disintegration rate of U^{233} produced by Pa^{233} decay. The value adopted for the counting efficiency, the average of three determinations, is 6.3×10^{-3} counts per disintegration.

4196

Argonne National Lab.
THE THERMAL NEUTRON REACTOR AS AN INSTRUMENT FOR MEASURING NEUTRON CROSS SECTIONS. Alexander Langsdorf, Jr. [nd] Decl. July 13, 1951. 131p. (AECD-3194; ANL-4342)

A dynamic method of measuring neutron cross sections has been developed, in which a sample to be measured is oscil-

lated in and out of the reactor periodically. The oscillating component of neutron flux so produced is measured in an electric circuit which receives current from an ionization chamber exposed to the neutrons. The method is quite sensitive and accurate. The number of neutron cross sections involved (simple capture, scattering, and capture with fission) and the wide range of neutron energies (thermal, epithermal, and fission energies) lead to complexity in analysis of results. The method is discussed and described in its applications to the thermal neutron reactors at ANL. (auth)

4197

Ames Lab.
BETA-RAY SPECTROMETRY WITH AN ANTHRACENE SCINTILLATION SPECTROMETER. James P. Palmer and L. Jackson Laslett. Mar. 14, 1951. 24p. (AECU-1220)

The block diagram of a scintillation coincidence spectrometer is given and is briefly discussed. A theoretical analysis of the response to monokinetic electrons is reported. Based on a calibration of the instrument by means of the internal conversion line from Cs^{137} and by the use of coincidence spectrometry, the end point of the lower beta ray of Rb^{86} is found to be 0.67 Mev, within an estimated 15% error. β spectra end points of 4.2 and 2.0 Mev for Ag^{112} and Ag^{113}, respectively, are obtained with an estimated accuracy of 8%. (auth)
24 references.

4198

Vanderbilt Univ.
A METHOD OF MEASURING CONVERSION COEFFICIENTS. (abstract) Thomas B. Cook, Jr., and S. K. Haynes. [nd] 1p. (AECU-1287)

The report is reproduced here in its entirety.

The problem of determining conversion coefficients of isomeric transitions which are not accompanied by continuous β spectra involves numerous uncertainties because electron and γ intensities must be compared. The use of scintillation spectrometers makes possible the determination of conversion coefficients by measurements involving only electron-electron and γ-γ intensity comparisons. An isotope is used for which α is known from comparison of conversion and β spectra and whose γ-ray energy differs little from the energy of the γ ray whose conversion coefficient is being measured. By duplicating the geometry, absorbers used to remove the β rays, and source conditions for the two isotopes, it may be assumed that the distortions in the two sets of data are similar and may therefore be neglected in comparing the two sets of data. If the foregoing conditions are satisfied, the calculation of the unknown conversion coefficient essentially involves a comparison of the areas under the two conversion lines, the heights of the Compton distributions produced by the two γ rays, and the known conversion coefficient. The measurement of α for the 390-kev transition in In^{115} by this method will be discussed.

4199

Case Inst. of Tech.
USE OF D_2O LOADED EMULSIONS. (Technical Report No. 8) Victor E. Krohn, Jr., and Erwin F. Shrader. Mar. 16, 1951. 49p. (AECU-1315)

A method is described for the procurement and systematic analysis of data from nuclear-track plates saturated with heavy water and exposed to γ rays. Preliminary results are given from a study of the angular distribution of protons from the $d(\gamma,n)p$ reaction; the spectra of the Case betatron when operated at 15 and 18 Mev; and absorption of the 15-Mev beam in a pressdwood phantom. (auth)

4200

RCA Labs. Div., Radio Corp. of America
TIME RESOLUTION OF SCINTILLATION COUNTERS; SUPPLEMENTARY REPORT. G. A. Morton. May 31, 1951. 20p. (AECU-1479)

The time error inherent in scintillation counters using the presently available crystals and multipliers has been calculated in order to obtain an indication of the direction in which improvements should be made to obtain better time resolution. The first part of the discussion concerns itself with the performance of crystals and multipliers. This is followed by a brief discussion of the effects of various factors in the multiplier which contribute to time error. (auth)

4201

Carnegie Inst. of Tech.
ON THE RESOLUTION OF SHORT TIME INTERVALS WITH SCINTILLATION COUNTERS. Sergio De Benedetti and H. J. Richings. Apr. 17, 1951. 9p. (NYO-779)

A simple coincidence circuit of resolving time of the order of 10^{-9} sec is described. Results are shown of performance tests using stilbene and solutions of terphenyl in xylene as sources of scintillations.

4202

Radiation Lab., Univ. of California
ALPHA-PARTICLE SPECTROGRAPH. F. L. Reynolds. Mar. 20, 1951. 19p. (UCRL-1200)

An α-particle spectrometer, using a 60°-sector magnet capable of focusing α particles of energies up to 14 Mev, is described. Application of the instrument, sample technique, focusing properties, and current supplies are discussed. Transmission is about 0.01% of the total solid angle of the sample with a resolution of 8 kev. (auth)

4203

Radiation Lab., Univ. of California
A TEN ATMOSPHERE EXPANSION CLOUD CHAMBER WITH THIN WINDOWS. (abstract) J. DePangher. Apr. 1951. 1p. (UCRL-1257)

The report is reproduced here in its entirety.

The space available for the formation of tracks is a cylindrical volume of 12-in. diam. and ½-in. height. A ¾-in.-thick lucite cylinder backed by a 5/16-in.-thick perforated stainless-steel cylinder make up the side wall. The perforation pattern is a compromise between strength and transparency, the latter being adequate for uniform illumination of the chamber interior as demonstrated by model tests. For photographing tracks from above, a Herculite glass cover plate is employed with 13½ in. diam. and

1¼ in. thickness. Adiabatic expansion is achieved by a pantograph (Powell, Rev. Sci. Instruments 20, 403(1949)) operated lucite piston and two expansion valves (Shutt and Whitmore, Rev. Sci. Instruments 21, 643(1950)) which dump the gas into two expansion vessels. The entrance window in a box 16 in. long closed at both ends by Be-Cu curved foils of 2 and 5 mil thickness. A second window is provided on the opposite side of the cloud chamber to minimize back scattering.

4204

DOUBLE FOCUSING WITH WEDGE-SHAPED MAGNETIC FIELDS. Morton Camac. Rev. Sci. Instruments 22, 197-204(1951) Mar.

Geometric focusing in two directions for charged particles of a single energy is produced with a wedge-shaped magnetic field. The uniform field in the gap focuses in the plane of the pole faces, while the fringe fields focus perpendicular to the pole faces. With a single wedge the energy dispersion is too large for the weak electron intensities available with the source employed; i.e., for a reasonable size of slit at the collector only a narrow energy width, and thus a small number of electrons, is accepted. With the use of two wedge-shaped fields the energy dispersion can take a wide range of values, even zero in the first order. General formulas for either one or two magnet systems are derived for the focusing conditions, the energy dispersion, the second-order beam spread, and the effect of source width. These formulas are then applied to two special cases from which practically all design requirements can be obtained. Finally, a design is recommended for which the following requirements are fulfilled: 5% energy spread in an inch collector slit, large angular collection, and the same size of source and collector slits. (auth)

4205

EMANATION MEASUREMENT AS AN ANALYTICAL RESEARCH METHOD. O. Gübeli and W. Kolb. Helv. Chim. Acta 33, 1526-34(1950) Oct. 16. (In German)

The individual determination of Ra and Th emanation as a method for the analytical investigation of sources has been developed on the basis of the closed-circulation principle. An amplifier circuit for a quartz-fiber electrometer is diagrammed. As little as 0.1 Mach unit may be determined. The method is particularly well suited to the determination of ThEm in the presence of RaEm.

4206

Commissariat á l'Énergie Atomique
AN IMPROVEMENT OF GEIGER-MUELLER COUNTERS FILLED WITH CO_2; extract from J. phys. radium 12, 146-8 (1951). (In French) J. Labeyrie. Feb. 1951. 2p. (CEA-73)

A procedure is described for the detection and quantitative determination of radioactive C by using CO_2 as the filling of a Geiger counter. By adding a small quantity of alcohol (1 cm Hg pressure) to the CO_2 filling and by adjusting the restoration time of the anode-potential to about 2×10^{-4} sec, curves with stable and well-defined plateaus at levels above 200 v are obtained, even at 15,000 pulses per minute. (auth)

4207

AN INSTRUMENT CONTAINING A GEIGER-MUELLER COUNTER FOR MEASURING STRAY RADIATIONS AND RADIOACTIVE CONTAMINATIONS. Luigi Terra and Franco Fossati. Radiologia med. 37, 217-24(1951) Mar. (In Italian)

Measurements of stray radiations in radiological laboratories were made with an instrument containing a brass-wall G-M counter. The primary beam of x rays, filtered in the usual way, was obtained with a tube voltage of 100 to 180 kv. The results, controlled with the aid of an ionization chamber, show the usefulness of the instrument in cases when the energy of the photons of the primary ray is not less than 100 kv.

4208

ON THE IDENTIFICATION OF HIGH ENERGY PARTICLES IN ELECTRON SENSITIVE PLATES; trans. from Bull. centre phys. nucl. univ. libre Bruxelles 6, Series 9, No. 11 (1950). G. Occhialini. 1950. 21p. (NP-3050)

This report is a translation from the French of the original article which was abstracted in Nuclear Science Abstracts as NSA 4-4975.

4209

Chemical Corps School, Army Chemical Center
RADIAC INSTRUMENTS LABORATORY MANUAL. Dec. 1950. 85p. (NP-3094)

Several experiments are outlined which are designed to aid in instruction in the use of radiation detecting instruments. The experiments include: Use of personnel dosage devices, calibrating G-M type of survey meters, scaler counting techniques, calibration check of an ion-chamber survey meter, shielding properties of common materials, determining absorption coefficients by use of the scaler, determining the mass of a point source of Ra, and determining an unknown isotope.

4210

A NEW METHOD OF DETERMINING THE CHARGE AND ENERGY OF HEAVY NUCLEI IN THE COSMIC RADIATION. A. D. Dainton, P. H. Fowler, and D. W. Kent. Phil. Mag. (7) 42, 317-23(1951) Apr.

The charge and energy of a heavy particle in cosmic radiation may be determined from the frequency of the accompanying delta rays and the multiple scattering in its path through an emulsion. The method is illustrated by the charge spectrum of 226 tracks in emulsions exposed at 95,000 ft. (auth)

4211

SILVER BROMIDE CRYSTAL COUNTERS. K. Alan Yamakawa Yamakawa. Phys. Rev. 82, 522-6(1951) May 15.

Single crystals of silver bromide and mixed crystals of sodium and silver chloride have been used to count ionizing radiation. The energy per ion pair in silver bromide for electrons was found to be ~5.8 ev. The mobility and the

mean free path for the trapping of electrons in the conduction band of silver bromide crystals at 77°K were found to be 210 cm^2/volt-sec and 5×10^{-4} cm^2/volt, respectively. A study of the polarization of the counters for β and γ radiation was also made. (auth)

4212

THINNING-DOWN EFFECT IN NUCLEAR PHOTOGRAPHIC TRACKS. Tchang-Fong Hoang. Nature 167, 644-5(1951) Apr. 21. (Letter to the editor)

The thinning down of the track of a heavy nuclear fragment as it nears the end of its range has been measured. The results of measurements of ten such tracks disagree with the formula and graph of Freier et al. (Phys. Rev. 74, 1828 (1948)). If a power law is assumed to represent the approximate value of the thin-down length: $L \approx aZ^n$, the author finds that the exponent is near unity.

4213

Atomic Energy Research Establishment, Harwell, Berks. (England)
WORKING INSTRUCTION MANUAL FOR MONITOR, RADIATION NO. 1021 (Cat. No. 3-7/3794) AND MONITOR, RADIATION NO. 1021B (Cat. No. 3-7/5692). [nd] 32p. (NP-3068)

A detailed description is given of the design, operation, and maintenance of the laboratory type instruments, 1021 and 1021B, designed for determining the presence and amounts of α, β, and γ radiation.

MESONS

4214

Radiation Lab., Univ. of California
PRODUCTION RATIO OF PHOTO-MESONS FROM BERYLLIUM. Heinrich A. Medicus. Mar. 1, 1951. 1p. (UCRL-1154)

The report is reproduced here in its entirety.

The method which was used for the determination of the ratio of negative to positive π mesons produced from photons on C (J. M. Peterson et al., Phys. Rev. (in press); E. M. McMillan et al., Science 110, 579(1949)) has been applied to Be. The collimated x-ray beam of the synchrotron (electron energy 322 Mev) strikes the Be target. The mesons emerge from the target at an angle of 90° to the beam direction and are detected in 200μ Ilford C_2-emulsions after traversing appropriate absorbers. The ratio, π^-/π^+, is determined from the observed numbers of σ mesons and π-μ decays. The preliminary ratio is 2.0 ± 0.3 for the energy range 40 to 70 Mev. This is considerably higher than the value of 1.3 for C. This effect can be explained from the higher neutron-proton ratio in the Be nucleus and from the fact that the loosely bound neutron participates relatively strongly in the meson production.

4215

Radiation Lab., Univ. of California
STUDIES ON THE PRODUCTION OF NEUTRAL MESONS BY PROTONS. (abstract) B. J. Moyer, R. Madey, R. H. Hildebrand, N. Knable, and R. Hales. Mar. 1, 1951. 1p. (UCRL-1155)

The report is reproduced here in its entirety.

Experiments are in progress in the deflected 340-Mev proton beam of the 184-in. cyclotron. Measurements of the yield of neutral mesons vs. target z will be reported. For the special case of p-p collisions the yield is observed to be $0 \pm 2\%$ of the yield from p-C nucleus collisions. The range of error should be reduced by experiments now in progress. Previous efforts at measuring π^0 production from p-H^2 collisions employing internal targets and a pair counter have suggested a yield of the order of 10% of that from p-O nucleus collisions, but probable errors were at least 50% of the effect. In measurements of π^0 production in H^1 and H^2 the yield is so low as to preclude coincidence detection of decay photons. Single high-energy photons are detected by counters recording each electron of a pair produced in a 3/16-in. Pb converter and separated by scattering. Data are being obtained on the correlation angle distribution for the coincident photons from π^0 decay, which will yield the π^0 momentum distribution. Early results show a maximum yield at a correlation angle near 90°, when the counter's target plane is normal to the beam.

4216

Radiation Lab., Univ. of California
ON THE PRODUCTION OF π^+-MESONS IN CARBON. E. M. Henley and R. H. Huddlestone. Apr. 4, 1951. 8p. (UCRL-1219)

The cross section for production of π^+ mesons by 345-Mev protons on carbon has been measured by Richman and Wilcox (Phys. Rev. 78, 496(1950)). This process has been treated on the basis of the phenomenological analysis of meson production in free nucleon-nucleon collisions carried out by Watson and Brueckner (Phys. Rev., in press). The meson spectra at 90°, corresponding to various momentum distributions assumed for C^{12}, are shown. The differences between the spectra at high meson energies indicate a fairly sensitive dependence on the assumed momentum distribution.

4217

Radiation Lab., Univ. of California
THE RATIO OF THE MASSES OF THE POSITIVE π AND μ MESONS. (abstract) Wilson M. Powell. Apr. 1951. 1p. (UCRL-1258)

The report is reproduced here in its entirety.

Photographs of the decay of π^+ mesons into μ^+ mesons were obtained in a cloud chamber with a magnetic field of 8200 gauss. If the meson beam is allowed to spray the top and bottom of the chamber, then occasionally very slow mesons scatter down or up into the gas of the chamber, and in a few cases π^+ mesons have been observed to come to rest before decaying. An error of 2.6% in the momentum of the μ^+ meson from a stopped π^+ meson gives a 1% error in the ratio of the masses. The same order of precision is possible if the π^+ meson is moving very slowly. By selecting only slowly moving π^+ mesons individual measurements have a probable error of around 3 electron masses, and the value of the ratio of the masses agrees well within experimental error with that obtained by other methods (Smith et al.,

Phys. Rev. 78, 86(1950);H. Bradner, UCRL-486, NSA 4-1456).

4218

Radiation Lab., Univ. of California
MESON MASS RATIO AND ENERGETICS OF MESON DECAY. (abstract) Wallace Birnbaum, Frances M. Smith, and Walter H. Barkas. May 4, 1951. 1p. (UCRL-1275)

The report is reproduced here in its entirety.

The π/μ meson mass ratio is being determined with new geometry, using similar range vs. momentum relations as were employed in the measurement of the π meson to proton mass ratio (Barkas, Smith, and Gardner, Phys. Rev. 82, 102(1951)). π and μ mesons from the target were selected magnetically to enter the emulsion with approximately equal velocities. Two distinct range distributions corresponding to two distinct masses were found. The dispersion observed is in agreement with range straggling theory. Present statistics give the value for the π/μ mass ratio as 1.317 ± 0.004. The absolute momentum, p_0, of the μ's from decay of π's stopping in the emulsion is also determined by comparison with μ's from the target which have momenta within a few per cent of p_0. For this purpose, the absolute value of the magnetic field intensity of the 184-in. cyclotron has been mapped (using a nuclear-flux) over the orbit of the mesons. Preliminary results give a value of 29.86 ± 0.06 Mev/C. From the foregoing two basic results, and setting the mass of the neutrino involved in the π-μ decay equal to zero, we obtain: π-μ mass difference = 66.46 ± 0.16 M_0, π mass = 276.1 ± 2.3 M_0, μ mass = 209.6 ± 2.4 M_0, as absolute values with no reference to the proton mass. The μ kinetic energy associated with $p_0 = 4.085 \pm 0.044$ Mev.

4219

DETERMINATION OF THE NUMBER OF NEUTRONS ASSOCIATED WITH THE STOPPAGE OF NEGATIVE μ-MESONS IN LEAD. Gerhart Groetzinger, Martin J. Berger, and Gordon W. McClure. Phys. Rev. 81, 969-72(1951) Mar. 15.

Negative mesons (at sea level and therefore assumed to be μ mesons) were focused onto a Pb absorber by means of a magnetic cosmic-ray spectrometer. The number of μ mesons which stopped in the absorber was determined with an anticoincidence arrangement. Neutrons issuing from the Pb absorber were registered during intervals of from 5 to 135 μsec after each such stoppage by a counting system consisting of enriched-BF_3 counters surrounded by 8 cm of paraffin whose efficiency was measured with the help of a calibrated Na-Be source of ~1-Mev photoneutrons. For 5500 stopped μ mesons, the average number of neutrons emitted per μ-meson stoppage was found to be 1.96 ± 0.72. This result is consistent with the assumption that a neutrino (or light neutral meson) is emitted in the interaction between a μ meson and a nucleon. (auth)

MOLECULAR STRUCTURE

4220

Metcalf Research Lab., Brown Univ.
A FURTHER TABULATION OF KINETIC ENERGY MATRIX ELEMENTS. (Technical Report No. 17) John B. Lohman. Feb. 14, 1951. 33p. (NP-3046)

In an extension of a tabulation of kinetic energy matrix elements by J. C. Decius (J. Chem. Phys. 16, 1025(1948)), the restriction to acyclic configurations has been removed, and a fourth coordinate type, an out-of-plane bending, has been added. A new notation for matrix elements is used. Eighty-nine kinetic energy matrix elements are tabulated for unrestricted values of molecular angles, and certain useful parameters are listed for tetrahedral and planar configurations.

NEUTRONS

4221

Princeton Univ.
THE DIFFUSION OF SLOW NEUTRONS IN ABSORBING MATERIALS. E. P. Wigner. [nd] Decl. May 14, 1951. 10p. (AECD-3151; A-20)

A simplified treatment of the problem of diffusion of slow neutrons is given in which the solution is obtained much more easily than in the transport problems of the kinetic theory of gases because of the fact that the collisions involving two molecules of the diffusing substance are neglected in the neutron diffusion case making the fundamental Boltzmann equation linear.

4222

Los Alamos Scientific Lab.
REMARKS CONCERNING VERY SHORT DELAYED-NEUTRON PERIODS. F. de Hoffmann and K. Way. [nd] Decl. May 22, 1951. 3p. (AECD-3153; LADC-921)

The question of the existence of a very short delayed-neutron period is briefly discussed. Special attention was given to the 6-msec (e-folding time) period from U^{235} reported in LA-252.

4223

Radiation Lab., Univ. of California
ANGULAR DISTRIBUTION OF NEUTRONS FROM TARGETS BOMBARDED BY 20-MEV DEUTERONS. L. Schecter. Mar. 28, 1951. 13p. (UCRL-1204)

Recent determinations of the spatial distribution of fast neutrons produced by the bombardment of various targets by deuterons of energy less than 20 Mev indicate that there is a group of neutrons emitted in a forward direction in addition to a roughly isotropic background. The present work establishes information about the neutron distributions from deuterons of maximum energy 20 Mev which shows that several different processes operate in the production of these neutrons, and that the neutron energies are characteristic of the processes producing them. The characteristics of the neutron distributions from Be, Al, Cu, Sn, Pb, and U are described in terms of the forward-to-isotropic yield ratio, the width at half-maximum, and the angular position of the maximum with respect to the incident beam direction. In each case there is a maximum in the forward direction superimposed on what appears to be an isotropic background. In the cases of Be and Cu, neu-

trons are emitted which above 20 Mev have their spatial maximum displaced from the direction of the incident deuteron beam. By comparing the theoretical and experimentally observed angular distributions in the cases of Be^{9}, Al^{27}, and Cu^{63} targets, it has been possible to find agreement good enough to assign parity and possible spin values to either the initial or final state, the other being assumed known.

4224

Oak Ridge National Lab., Y-12 Area
ON THE (n,2n) REACTION IN BERYLLIUM WITH NEUTRONS OF A POLONIUM-BERYLLIUM SOURCE; trans. from Nachr. Akad. Wiss. Göttingen, Math.-physik. Klasse IIb Abt. p.52 (1946). F. G. Houtermans; tr. by William Krasny Ergen. Apr. 20, 1951. 7p. (Y-F20-12)

This report is a translation from the Russian of the original article which was abstracted in Nuclear Science Abstracts as NSA 1-290.

4225

Great Britain
A COMPARISON OF THE APPROXIMATE METHODS OF CALCULATING THE CRITICAL SIZE OF A SPHERE. A. H. Wilson. [nd] 5p. (MS-89)

The elementary diffusion theory and the infinite medium theory have been used as methods of solving the integral equation which determines the neutron density in critical conditions for bodies of spherical and nonspherical shape. Comparison is made of the two methods.

NUCLEAR PHYSICS

4226

Brookhaven National Lab.
PHYSICS DEPARTMENT, p.1-32 of QUARTERLY PROGRESS REPORT; OCTOBER 1–DECEMBER 31, 1950. Mar. 1951. 32p. (BNL-93(p.1-32))

Dynamic Properties of Nuclei. Results of measurement of the isomeric transition energies of Sc^{48m}, Se^{77m}, Rh^{104m}, Sb^{122m}, Hf^{m} (19-sec), and Ir^{192m}; γ rays in Rh^{106} and Pr^{144} decay; radiations from Sn^{113}; cross-over transitions in Tc^{99m}; low-energy γ and α radiations from Pa^{231} and U^{234}; γ-γ correlation with higher multipoles; heat production in K; and n-D scattering at 1.4 Mev are summarized. Statuses of studies on scintillation spectrometry technique, response of scintillators to recoils from 14-Mev neutrons, activation of scintillating crystals, differential cross sections in the scattering of 14-Mev neutrons by protons, coherent n-p scattering by liquid-mirror reflection, inelastic scattering of low-energy neutrons in graphite, and coherent neutron scattering from gases are reported briefly. Stationary Properties of Nuclei. Observed mass defects in the region of Al^{27}, Si^{28}, Si^{29}, Si^{30}, and S^{32} are compared with best-fit values. Masses of Rb^{85} and Rb^{87} as measured with a new magnetic time-of-flight spectrometer are given, and equations of nuclear effects in paramagnetic absorption according to Kramer's theorem are derived. High-energy-particle Physics. Development of the theory of diffusion cloud chambers, operation of diffusion cloud chambers at high pressures, effect of cosmic-ray proton energy on multiplicities in stars from large and small nuclei, nuclear disruptions under graphite by cosmic rays, and the nucleonic component of extensive air showers are discussed. Theoretical Topics. Statuses of calculations on the statistical theory of cascade showers, on criteria for multiple scattering, and on a phenomenological treatment of photomeson production from deuterons are reported.

4227

Radiation Lab., Univ. of California
HIGH ENERGY CARBON PARTICLES. Cornelius A. Tobias. June 1942. 56p. (UCRL-1039)

$C^{12}(+6)$ and other nuclei having approximately the same e/m ratio as deuterons can be accelerated in the cyclotron under similar conditions to those required by the deuteron beam. In the ratio of their mass to the mass of deuteron their kinetic energy will be greater. By using them, new types of nuclear reactions could be detected, namely, ones involving higher excitation energies than hitherto known. The use of CO_2 made the acceleration of C easiest. The Gamow theory of penetration of nuclear barriers was applied in the case of light-bombarding nuclei. The electric moment induced in the bombarding particles at the approach of a nucleus is discussed. Its values may lead to the splitting off of α particles before the potential barrier can be penetrated. The tracks due to the 96-Mev C particles accelerated in the 60-in. cyclotron were recorded in photographic emulsions. Their grain density, track length, and the total number of grains have been measured and plotted in relation to the specific ionization and the air equivalent range. Some of the microphotographs taken show elastic collisions with various nuclei. A few pictures may represent inelastic collisions. Two star-shaped inelastic collisions were found and analyzed. (auth)

4228

THE ASSOCIATION MECHANISM OF ELEMENTARY PARTICLES. Ioan I. Placinteanu. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 8, 587-92(1950) June. (In French)

Based on certain theorems of Armellini and Levi-Civita concerning a two-body system whose Hamiltonian is a function of slowly varying "adiabatic" parameters, the following two rules are postulated on the process of association of various particles into a nucleus: (1) if the masses of two associating particles and the distance between them vary adiabatically, the ratio between the distance and the reduced mass in the resulting nucleus is a constant; (2) the individual angular velocities of rotation both become equal to the angular velocity of revolution around the center of mass. From these postulates inferences are made on the approximate values of magnetic moments and spins of various associations, such as neutron-neutron, neutron-proton, deuteron-deuteron, proton-electron, etc.

4229

CHERENKOV'S EFFECT FOR THE MESON FIELD. D. I. Blokhintsev and V. L. Indenbom. Zhur. Eksptl'. i Teoret. Fiz. 20, 1123-9(1950) Dec. (In Russian)

Wade (Phys. Rev. 75, 981(1949)) and Ivanenko et al. (Doklady Akad. Nauk S.S.S.R. 67, 997(1949)) have pointed out the

possibility of a mesonic analog to Cherenkov's electromagnetic radiation, which should take place when a fast nucleon traverses the field of the mesons in the interior of a nucleus. The theory of such an effect is investigated, and it is concluded that the meson-field radiation produced by the nucleon within the nucleus will not be accompanied by a generation of mesons; however, mesons can be generated through the effect under study as the nucleon traverses the outer zone of the nucleus.

4230

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
ELEMENTARY PARTICLE SCATTERING GROUP, sect. 3 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. J. R. Zacharias. Jan. 1, 1951. 3p. (NP-1857(sect.3))

Operational information and brief statements of experiments in progress on the 1-Mev van de Graaff, photodisintegration experiments with the cyclotron, nuclear emulsions, linear accelerator (new concrete shielding is illustrated), and α-γ angular correlation are presented.

4231

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
RADIOACTIVITY AND CYCLOTRON GROUP, sect. 8 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. R. D. Evans and M. S. Livingston. Jan. 1, 1951. 5p. (NP-1857(sect.8))

Angular β-γ correlation functions for Sb^{124} and Rb^{86} are presented graphically. A β-γ correlation of about +0.13 has been found for 460-kev β rays in the decay of I^{126}. The fact that an apparatus to measure triple γ-ray coincidences and a new six-channel short-resolving-time delayed-coincidence circuit for measurement of the lifetime of slow positrons have been built is mentioned. Details of investigations of the reactions $Li^7(p,p')Li^{7*}$ and $Li^7(\alpha,\alpha')Li^{7*}$ are given. The average Q value for the Li energy level of all reactions studied is 4.77 ± 0.10 Mev. The angular distribution of the long-range proton group from $Al^{27}(d,p)$ for 4.6-, 5.8-, 7.5-, and 14-Mev deuterons; angular distributions of the ground-state deuteron group from $Be^9(p,d)$ for 4.8-, 5.9-, 6.9-, and 7.8-Mev protons; and differential cross sections for elastic scattering of protons and α particles from Li^7 are presented graphically and discussed. Statuses of gas-target bombardments, a new external-beam monitor, and proportional-counter studies are summarized briefly.

NUCLEAR PROPERTIES

4232

Purdue Univ.
ANGULAR CORRELATION OF THE GAMMA-RAYS EMITTED FROM THE EXCITED STATES OF Pt^{196}. (abstract) R. M. Steffen and D. M. Roberts. [nd] 1p. (AECU-1304)

The report is reproduced here in its entirety.

The nuclide Au^{196} ($T_{1/2}$ = 5.6 days) decays by K-capture into Pt^{196} leading to two excited states of 0.688- and 0.358-Mev energy and also by β^- emission into Hg^{196} (Steffen et al., Helv. Phys. Acta 22, 167(1949)). The angular correlation of the two successively emitted γ rays following the K-capture has been measured, using the apparatus described before (Steffen, Phys. Rev. 80, 115(1950)). The experimental data are well represented by the correlation function $f(\theta) = 1 - {}^{15}/_{13}\cos^2\theta + {}^{15}/_{13}\cos^4\theta$, which is characteristic for two quadrupole transitions between states of angular momentum 2,2 and 0 (Hamilton, Phys. Rev. 58, 122(1950)). The conversion coefficients (Steffen et al., loc. cit.) of the two γ rays indicate electric quadrupole transitions suggesting the same parity for all three levels involved. These assignments, however, lead to the difficulty that the cross-over transition should be predominant, whereas the intensity of this transition has been measured to be less than 5%. The spin and parity assignments of all the excited levels involved in the dual decay of Au^{196} are discussed.

4233

Columbia Univ.
BETA-GAMMA ANGULAR CORRELATIONS IN Sb^{122}. (abstract) I. Shaknov. [nd] 1p. (CUD-85)

The report is reproduced here in its entirety.

An investigation of the total and differential angular correlation coefficients in Sb^{122} has been performed in this laboratory. Both β and γ detectors were anthracene crystal counters with 5819 photomultipliers. The pulses were amplified with a wide-band amplifier, then shaped by shorted delay lines and fed to a fast coincidence circuit. Using a T junction, the pulses from the β counter were branched to a differential pulse-height analyzer. The output of this analyzer was used to gate the fast coincidence output, thus accepting only coincidences in which the β-particle energy fell in the proper energy interval. The sources were placed under vacuum in a Lucite chamber. The apparatus was checked for performance by measuring total correlation coefficients in the following substances: γ-γ correlations in Co^{60} and Rh^{106}; β-γ correlations in Au^{198}, Na^{22}, and Sb^{124}. In all cases results agreed with previous work of other investigators. A thin source of Sb^{122} was prepared by vacuum evaporation onto a thin Formvar film. The total correlation coefficient, assuming $W(\theta) = 1 + R/Q\cos^2\theta$, was found to be R/Q = +0.067 ± 0.01, while the coefficient, accepting β particles of a narrow energy interval in the high-energy region was R/Q = +0.157 ± 0.02.

4234

Radiation Lab., Univ. of California
SHORT RANGE CORRELATIONS IN NUCLEAR STRUCTURE. (abstract) K. A. Brueckner and K. M. Watson. Mar. 1951. 1p. (UCRL-1171)

The report is reproduced here in its entirety.

It has been observed experimentally by Panofsky that the capture of π mesons in deuterium (Phys. Rev. 81, 565(1951)) leads to a ratio of nonradiative to radiative capture of 7 to 3, while in C the ratio is greater than 200 to 1. It is possible to show that the difference can be attributed almost entirely to the existence of stronger short-range correlations in nucleon positions in C than in deuterium. The explicit calculation involves an integral over the coordinates

of the initial and final nuclei which may be simplified by application of an approximate closure rule to the wave functions of the final nuclei. Further simplifications can be made by introduction of the transition matrix leading to meson absorption, as deduced from the deuteron absorption experiments. The remaining integral is interpreted as representing the probability of finding in contact the two nucleons involved in the act of absorption. Comparison with experiment shows that this probability is much greater than the random probability based only on nuclear volume, or that deduced, for example, from a Fermi distribution. This effect is presumably due to the strong short-range nucleon-nucleon interaction.

4235

Radiation Lab., Univ. of California
A SEARCH FOR AN EXCITED He^4 LEVEL. (abstract) J. Benveniste and Bruce Cork. May 3, 1951. 1p. (UCRL-1272)

The report is reproduced here in its entirety.

Evidence for the existence of an excited state of He^4 has been presented (Argo, Gittings, Hemmendinger, Jarvise, Taschek, Phys. Rev. 78, 691(1950)). In this laboratory the proton linear accelerator has been used in a search for an excited level by the method of inelastic scattering of 31-Mev protons from He^4 nuclei. Laboratory angles of 30, 45, and 60° have been investigated by means of a telescope consisting of two gas counters in coincidence followed by an anticoincidence counter. A differential range analysis of the spectrum of scattered particles shows the elastically scattered protons and α particles with good resolution. Also, a third peak is observed which can at present here be explained as deuterons from the reaction $He^4(p,d)He^3$. This peak has a differential cross section of approximately 8×10^{-27} cm^2 at 45° in the laboratory system. An upper limit for the differential cross section at 45° for the reaction $He^4(p,p')He^{4*}$ (if it exists at all) is 3×10^{-27} cm^2. Further investigations of particles scattered from He^4 are being made by differential energy analysis in a NaI (Tl) crystal.

4236

A DIRECT DETERMINATION OF THE MAGNETIC MOMENT OF THE PROTONS IN UNITS OF THE NUCLEAR MAGNETON. C. D. Jeffries. Phys. Rev. 81, 1040-55(1951) Mar. 15.

A direct measurement of the proton magnetic moment has been made, using the method of Alvarez and Bloch (Phys. Rev. 57, 111(1940)). The experiment consists of comparison of the nuclear magnetic resonance frequency of protons with the orbital frequency of protons revolving in the same homogeneous field. The resonance frequency of protons in water has been measured by the method of nuclear induction; the orbital frequency has been measured by a special device: a small decelerating cyclotron operated at an odd multiple of the fundamental cyclotron frequency. An approximate theory for the shape of the cyclotron resonance curves has been developed, and its qualitative agreement with the observations has been established. The perturbing effects of extraneous electric and magnetic fields have been investigated, both theoretically and experimentally, and found to be negligible. With the smallest relative half-width of resonance about $^1/_{10,000}$, which was observed at the higher multiples, and guided by the interpretation of the resonance shape, the magnetic moment of the proton has been found to be 2.7924 ± 0.0002 n.m. (auth)

4237

ELECTRON-NEUTRINO ANGULAR CORRELATION. E. Greuling and M. L. Meeks. Phys. Rev. 82, 531-7(1951) May 15.

Angular correlation functions are calculated for allowed and first-forbidden β-decay transitions including the effect of the nuclear coulomb field. The process of β decay is viewed as a kind of scattering in which an incident negative-energy neutrino is transformed by the Fermi interaction into a scattered electron in a positive-energy state. The outgoing electronic wave function is calculated, and the angular-correlation functions are determined from the angular-dependent electron probability current through sections of a sphere at large distances from the nucleus. For allowed transitions the angular correlation is found to be independent of atomic number and identical with the results of previous calculations which assumed $Z = 0$ (D. R. Hamilton, Phys. Rev. 71, 456(1947)). The $Z = 0$ approximation is shown to be unreliable for first-forbidden transitions in which correlation terms proportional to the first and second powers of the potential energy of an electron at the surface of the nucleus appear. This effect is important even for moderately heavy nuclei. (auth)

4238

NUCLEAR AUDIOFREQUENCY SPECTROSCOPY BY RESONANT HEATING OF THE NUCLEAR SPIN SYSTEM. N. F. Ramsey and R. V. Pound. Phys. Rev. 81, 278-9(1951) Jan. 15. (Letter to the editor)

A new nuclear-magnetic-resonance technique with high sensitivity at low frequencies of the oscillating magnetic field has been investigated. This method makes use of the long relaxation time of a pure single crystal. The crystal is removed from a strong magnetic field for a short time compared to the relaxation time of the crystal and during this short interval is placed in a weak audiofrequency magnetic field. In this way the audiofrequency spectrum of LiF was studied between 20 and 200,000 cps with audiofrequency magnetic fields at 0.018 gauss applied for 3 sec. A nuclear audiofrequency spectrum was observed which possessed a broad maximum at 50 kc.

4239

THE NUCLEAR EXCITATION OF Ag^{107} AND Ag^{109} BY X-RAYS. Eligius J. Wolicki, Bernard Waldman, and Walter C. Miller. Phys. Rev. 82, 486-8(1951) May 15.

X rays produced by monoergic electrons were used to excite the separated isotopes of Ag to their metastable states. The half life of Ag^{107*} was found to be 44.0 ± 1.0 sec. The half life of Ag^{109*} was found to be 40.0 ± 1.0 sec. These measurements are in agreement with those of Bradt et al. (Helv. Phys. Acta 20, 153(1947)) and the isotopic assignment of Helmholz. The electron energy was varied between 0.8 and 2.3 Mev in order to obtain the excitation curves. The threshold for x-ray excitation of both Ag^{107} and Ag^{109} were found to be below 0.8 Mev. An activation

level in Ag^{107} was found at 1.285 ± 0.018 Mev. An activation level in Ag^{109} was found at 1.210 ± 0.018 Mev. The over-all cross section (i.e., per incident electron on thick gold target) is of the order of 10^{-34} cm^2 for both isotopes at 1.4 Mev. (auth)

4240

ON THE NUCLEAR MAGNETIC RESONANCE IN AN ANTIFERROMAGNETIC CRYSTAL. N. Bloembergen and N. J. Poulis. Physica 16, 915-19(1950) Dec.

The observation of the nuclear magnetic resonance in antiferromagnetic crystals should give information about the spin alignment in these crystals. An attempt to observe the F^{19} resonance in a single crystal of MnF_2 yielded a negative result. The absence of the nuclear resonance is attributed to a very short nuclear relaxation time t_1 ($<10^{-6}$ sec). (auth)

4241

A PROPERTY OF THE MASS-RATIO $m_{Cl^{35}}/m_{O^{16}}$. P. Torkington. J. Chem. Phys. 19, 659(1951) May. (Letter to the editor)

The letter is reproduced here in its entirety.

While engaged on calculations of the properties of vibrations of the chlorine monoxide molecule, a property of the mass-ratio $\mu = m_{Cl^{35}}/m_{O^{16}}$ was observed which may be of interest. It is found that for these masses $\mu(1 + 2\mu) = 11.7464$ and $1 + 2(1 + 2\mu) = 11.7454$. This appears rather a remarkable coincidence. In the present instance it led to misapplication of formulas—it was some time before the identity was established. If the two functions are equated, then the mass ratio arises as the positive root of the equation $(1 + 2\mu)(\mu - 2) = 1$, or $2\mu^2 - 3(\mu + 1) = 0$. It would be of interest if either of such identities existed.

4242

QUADRUPOLE RESONANCE FREQUENCIES OF Cl AND Br NUCLEI IN CRYSTALLINE DICHLOROETHYLENE AND METHYL BROMIDE. H. G. Dehmelt and H. Krüger. Z. Physik 129, 401-15(1951) Apr. 2. (In German)

Two absorption lines, $(35.480 \pm 0.003) \times 10^6$ sec^{-1} and $(27.963 \pm 0.003) \times 10^6$ sec^{-1}, were observed at 83°K in samples of polycrystalline trans-dichloroethylene placed in the oscillating coil of a regenerative oscillator described by Roberts (Rev. Sci. Instruments 18, 845(1947)). The lines, attributed to the two stable Cl isotopes, correspond to transitions between terms whose energy differences are determined by interactions between the quadrupole moment of the Cl nucleus and the nonhomogeneous electric field of the molecule. The observed transition frequencies increase slightly with decreasing temperature, their ratio remaining constant. From this ratio, by assuming equal molecular fields, the ratio between the nuclear quadrupole moments of Cl^{35} and Cl^{37} was found to be 1.2688 ± 0.0002. In a similar manner, using polycrystalline methyl bromide at 83°K, lines $(264.45 \pm 0.03) \times 10^6$ sec^{-1} for Br^{79} and $(220.91 \pm 0.03) \times 10^6$ sec^{-1} for Br^{81} were measured. The corresponding ratio of nuclear quadrupole moments is 1.1970 ± 0.0002. (auth)

4243

SOME NEW ATOMIC MASS MEASUREMENTS AND REMARKS ON THE MASS EVIDENCE FOR MAGIC NUMBERS. Henry E. Duckworth and Richard S. Preston. Phys. Rev. 82, 468-70(1951) May 15.

New mass measurements are given for the nuclei Ti^{46}, Sr^{84}, Sr^{88}, Mo^{96}, Sn^{117}, Sn^{120}, Pt^{194}, Pt^{198}, and Pb^{208}. The evidence given for the theory of magic numbers in nuclear structure by nuclear-mass measurements is discussed. The mass evidence to date gives general support to the level scheme of Maria Mayer (Phys. Rev. 75, 1969(1949); 78, 17(1950)). (auth)

NUCLEAR REACTORS

4244

Los Alamos Scientific Lab. FORMULA FOR WATER-BOILER FLUCTUATION. Frederic de Hoffmann. Jan. 22, 1946. Decl. May 22, 1951. 10p. (AECD-3152; LADC-920)

An alternate derivation for formula (9) of LA-101 is given for the quantity $(\overline{C^2} - (\overline{C})^2)/\overline{c}$ which is the direct measure of the reactor fluctuations where $\overline{c} = \sum_i c_i^s$; c_i^s being the number of counts recorded in time i from the s'th source particle.

NUCLEAR TRANSFORMATION

4245

Los Alamos Scientific Lab. FISSION SPECTRUM. F. Bloch and H. Staub. 1943. Decl. May 4, 1951. 74p. (AECD-3158; LADC-934)

Measurements of the spectrum of the fission neutrons of U^{235} are described, in which the energy of the neutrons is determined from the ionization produced by individual H recoils. The slow neutrons producing fission are obtained by slowing down the fast neutrons from the Be-D reaction of the Stanford cyclotron. The results show a continuous distribution of neutrons with a rather wide maximum at about 0.8 mv falling off to half of its maximum value at 2.0 mv. The total number of neutrons is determined by comparison with the number of fission fragments. The results indicate that only about 30% of the neutrons have energies below 0.8 mv. Various tests are described which were performed in order to rule out modification of the spectrum by inelastic scattering. Apparatus and experimental techniques are described in detail.

4246

Los Alamos Scientific Lab. PRELIMINARY SEARCH FOR FISSION INDUCED FISSION. J. L. Fowler. Jan. 2, 1948. Decl. May 22, 1951. 13p. (AECD-3160; LADC-947)

An investigation has been made of the possibility of fission-induced fission of the Th nucleus. Results indicate that if fission fragments produce an effect at all it is less than 0.1% of that due to neutrons.

4247

Wisconsin Univ.
DISINTEGRATION OF NEON BY FAST NEUTRONS. C. H. Johnson, C. K. Bockelman, and H. H. Barschall. [nd] 6p. (AECU-1308)

Measurements have been made of the cross section for the disintegration of Ne^{20} by fast neutrons using equipment previously described (Phys. Rev. 80, 818(1950)). Distribution curves taken at intervals of about 0.2-Mev neutron energy reveal only one group of disintegration pulses. In addition to the Ne disintegrations, pulses from a Po α-particle source in the counter were registered at each neutron energy. It was found that the disintegration pulses had an energy of 0.75 ± 0.05 Mev less than the incident neutrons. A pulse-height distribution curve is shown as obtained with 2.45-Mev neutrons. A plot is shown of the disintegration cross section of Ne as a function of neutron energy. Three prominent resonance peaks were observed at 2.45, 2.87, and 3.26 Mev with peaks of less magnitude at 2.12, 2.62, and 2.72 Mev. A cross section of about 20 mb was obtained.

4248

California Univ., Berkeley
FISSION OF MEDIUM WEIGHT ELEMENTS. (thesis) Roger Elwood Batzel. [nd] 63p. (UCRL-1100)

An account is given of results of work on two types of high-energy nuclear reactions, namely fission and spallation reactions. Evidence is presented which indicates that large fragments (much larger than α particles) are emitted among the competitive products of transmutation throughout the entire range of atomic numbers of the elements. Threshold considerations for these nuclear reactions show that they are observed with cross sections well below the threshold for spallation reactions in which the maximum number of α particles are considered as being emitted from the excited nucleus. The calculated thresholds include the mass difference between the reactants and the products and the excitation energy which the product particles must have in order to pass over the coulombic barrier. Preliminary experiments on the ranges of recoil fragments from Cu irradiated with 340-Mev protons give additional evidence for the emission of heavy fragments. Studies have shown that the reaction products cover a range of 40 or more nucleons. The yields of the various products were measured, and the results show that a large majority of the products result from reactions in which only a fraction of the total energy of the incident proton is left with the nucleus. The observed spallation products include some 35 nuclides from Na through Zn. Observed yields show the effects of nuclear transparency and are consistent with Serber's idea that the nuclear reactions involve excitation following collisions and energy transfers between the impinging proton, or the individual nucleons in the impinging particle in the case of deuterons and He ions, and the individual nucleons in the target nucleus.

4249

Radiation Lab., Univ. of California
PRECISION ANALYSIS OF GAMMA RAY SPECTRA FROM HIGH ENERGY PROTON COLLISIONS WITH NUCLEI. (abstract) Kenneth M. Crowe, Wolfgang K. H. Panofsky, Robert H. Phillips, and Darcy Walker. May 1951. 1p. (UCRL-1270)

The report is reproduced here in its entirety.

The γ-ray spectra of the type measured by Bjorklund, Crandall, Moyer, and York (Phys. Rev. 77, 213-8(1950)) have been remeasured with the multiple channel (Aamodt, Hadley, and Panofsky (Phys. Rev. 81, 565(1951)) pair spectrometer previously described. The rate of data collection has been improved by the addition of a 196 coincidence pair computer. The results of these spectra, incorporating of the order of 10^5 pairs, are as follows: (1) The γ-ray spectra from C and from W are indistinguishable. This contradicts the results of earlier experiments that the difference in internal momenta between heavy and light elements materially affects the meson spectrum. (2) Comparison between 0 and 180° spectra makes an analysis of the spectrum into a pure π^0 effect impossible. It rather indicates that a mechanism other than bremsstrahlung and π^0 decay exists which contributes to the spectrum near 100 Mev. It is suggested that this mechanism might be production of π mesons in one nucleon and reabsorption in another.

4250

ANGULAR YIELD OF PROTONS, TRITONS, AND ALPHAS FROM THE DEUTERON BOMBARDMENT OF BERYLLIUM. I. Resnick and S. S. Hanna. Phys. Rev. 82, 463-7(1951) May 15.

The photographic target chamber incorporating limited magnetic deflection of product particles has been applied to the Be + d reactions. Angular yields of the long- and short-range protons, the tritons, and the unresolved α's were obtained at bombarding energies below 1 Mev. Most of the distributions are fairly complex and energy dependent. The 90° yield of the long-range protons increases rapidly with energy up to 900 kev, except for an anomaly at 700 kev. Tritons having a continuous distribution in energy, resulting from the three-particle disintegration $Be^9(d,t)2\alpha$ were observed. Range measurements on the monoenergetic triton group give a Q = 4.61 ± 0.04 Mev for the $Be^9(d,t)Be^8$ reaction. 9 graphs. (auth)

4251

THE EMISSION OF SHORT-RANGE CHARGED PARTICLES IN THE SLOW NEUTRON FISSION OF URANIUM. K. W. Allen and J. T. Dewan. Phys. Rev. 82, 527-30(1951) May 15.

A coincidence-counting method has been employed to investigate short-range charged particles produced in the slow-neutron fission of U^{235} and U^{233}. In the case of U^{235}, charged particles with ranges up to 8 mm of air were observed with a frequency of one in 76 ± 8 fissions. The maximum initial specific ionization of these particles was ten times that of α particles from U, which suggests that some of the particles have masses considerably greater than that of the α particle. The mass distribution could not be determined from the experimental data. Additional experiments proved that the observed particles were not nuclear recoils produced by fission fragments in their passage through the source and counter gas or fission fragments scattered by the backing material of the source. In the fission of U^{233}, particles were observed with ranges up to 7.4 mm of air with an abundance of one in 72 ± 6 fissions. (auth)

4252

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CROSS SECTIONS GROUP, sect. 7 of PROGRESS REPORT [NINETEENTH FOR FOURTH QUARTER OF 1950]. W. W. Buechner. Jan. 1, 1951. 9p. (NP-1857(sect.7))

Results of studies on the reactions $D^2(d,p)T^3$; $C^{13}(d,t)C$; $F^{19}(d,p)F^{20}$; $Na^{23}(d,p)Na^{24}$; $Al^{27}(d,p)Al^{28}$; and $Si^{30}(d,p)Si^{31}$ are discussed in some detail. A complete list of Q values for 38 different reactions is given. From these data the mass of He^4 has been calculated to be 4.003865 ± 0.000007. This value is discussed in relation to that found by other investigators.

4253

NUCLEAR RECOILS RESULTING FROM THE DECAY OF Be^7. Philip B. Smith and James S. Allen. Phys. Rev. 81, 381-5(1951) Feb. 1.

Be^7 was deposited as a thin film on a Ta foil. The energy spectrum of the Li^7 recoils from the reaction $Be^7 + e \rightarrow Li^7 + \nu + Q$ was studied. The observed spectra did not exhibit the monoenergetic character predicted by theory. The maximum energy of the recoils was 56.6 ± 1.0 ev, corresponding to a Be^7-Li^7 mass difference of 860 ± 8 kev. This mass difference, in combination with the best value of the $Li^7(p,n)Be^7$ threshold, yields 785 ± 8 kev for n-H. Coincidence measurements were made which indicated that monolayer surfaces were probably produced. Auger electrons following the K capture were observed. The variation of the shape of the recoil energy spectrum was studied as a function of the temperature of the backing foil. (auth)

4254

Q-VALUES OF THE (p,α) REACTIONS IN LITHIUM-6, LITHIUM-7 AND NITROGEN-15, AND THE Bρ VALUES OF THORIUM C′ AND POLONIUM ALPHA-PARTICLES. E. R. Collins, C. D. McKenzie, and C. A. Ramm. Nature 167, 682-3(1951) Apr. 28. (Letter to the editor)

Values are presented as obtained with the use of a uniform field magnetic spectrometer in conjunction with a high-voltage accelerator.

4255

THE REACTION ENERGIES OF LIGHT NUCLEI FROM MAGNETIC ANALYSIS. E. N. Strait, D. M. Van Patter, W. W. Buechner, and A. Sperduto. Phys. Rev. 81, 747-60 (1951) Mar. 1.

An extensive survey has been made of the reaction energies of ground-state transitions induced by proton and deuteron bombardment of light nuclei. A total of 19 stable nuclei from deuterium through sulfur was investigated, and the Q values directly measured for 38 different reactions. From these Q values, the energy releases of a number of other reactions have been computed. The reactions studied include the (p,α), (d,p), and (d,α); and the individual Q values have been determined to precisions that are between 0.08 and 0.25%. The reaction products were analyzed by means of 180° focusing in the field of a large annular magnet. The Q values measured include those of a series of nuclear reactions which directly connect the mass of the α particle with the deuteron mass and O^{16}. From these measurements, the mass of the α particle has been determined as 4.003865 ± 0.000007 amu. (auth)

4256

THE RELATIVE PROBABILITIES AND ABSOLUTE CROSS SECTIONS OF THE D-D REACTIONS. K. G. McNeil and G. M. Keyser. Phys. Rev. 81, 602-6(1951) Feb. 15.

Measurements with a gas target have been made of the relative probabilities and absolute cross sections of the two possible D-D reactions, by simultaneously counting the He and H nuclei produced by the reactions. The counters were separated from the target by a thin silica window. The ratio of the cross section of the neutron-producing reaction to that of the proton-producing reaction was found to increase from 0.95 at 120 kev to 1.06 at 250 kev. The "neutron" cross section was 0.019 barn at 120 kev and 0.038 barn at 250 kev, while the "proton" cross section increased from 0.020 barn at 120 kev to 0.049 barn at 300 kev. The results can be fitted to an expression of the form $\sigma E = \Sigma a_i P_i$, and the values of the coefficients a_i are given. (auth)

4257

THICK TARGET FAST NEUTRON YIELD FROM 15-MEV DEUTERON AND 30-MEV ALPHA-BOMBARDMENT. A. J. Allen, J. F. Nechaj, K. H. Sun, and B. Jennings. Phys. Rev. 81, 536-9(1951) Feb. 15.

The total yield and angular distribution of fast neutrons from bombardment of thick targets of pure Be, Al, Ti, Cr, Mn, Co, Nb, Mo, Ag, Cd, Ta, Au, Pb, and Bi by 15-Mev deuterons and 30-Mev α particles was measured. These studies were made using the reaction $S^{32}(n,p)P^{32}$ as a threshold detector and also with fission ionization chambers. The total neutron yield per sec per μ amp of the cyclotron beam, N, was observed to decrease with increase in nuclear charge, Z, of the target according to the approximate empirical equations, $\log N = 10.18 - 0.0234Z$ for deuteron bombardment and $\log N = 9.68 - 0.0234Z$ for α. In all cases studied, the angular distribution of fast neutrons from target bombarded by deuterons showed a pronounced peak in the yield in the forward direction. (auth)

PARTICLE ACCELERATORS

4258

Nebraska Univ.
STUDY OF THE RANGE ENERGY RELATION FOR SLOW IONS. T. Jorgensen. Mar. 1951. 40p. (AECU-1298)

A recently constructed Cockcroft-Walton type ion accelerator and auxiliary equipment are described in detail. Measurements made of the range of protons in air and H have revealed that at 37 kv the product of the range by the pressure seems at lower pressures to be a linearly increasing function of the pressure. At higher pressures in air the range-pressure product becomes more nearly constant with pressures. Observation has been made of what appears to be a resonance peak in the rate of loss of energy of protons with distance for protons in tank hydrogen at proton energy of about 23 kv. There are some indications that a similar

effect exists for protons in air. Results are shown graphically. Circuit diagrams are shown of the 0- to 40-kv accelerating supply regulator and of the magnet current regulator. 18 photographs.

4259

Brookhaven National Lab.
ACCELERATOR PROJECT, p.42-8 of QUARTERLY PROGRESS REPORT; OCTOBER 1–DECEMBER 31, 1950. Mar. 1951. 7p. (BNL-93(p.42-8))

Status of construction of Cosmotron components, tests on vacuum properties of Myvaseal rubber, and operation of the 60-in. cyclotron are summarized briefly.

4260

ON THE ARTICLE BY D. L. SIMONENKO "A METHOD FOR PRODUCING BEAMS OF MOLECULES." M. M. Bredov, V. M. Dukel'skiĭ, and V. M. Tuchkevich. Zhur. Eksptl'. i Teoret. Fiz. 20, 1143(1950) Dec. (In Russian)

In Zhur. Eksptl'. i Teoret. Fiz. 20, 385(1950); (see NSA 5-1042) Simonenko has described experiments with electron beams crossing the path of beams of positive ions. He interpreted his observations as a neutralization of the ions and a formation of beams of neutral molecules. This interpretation is questioned. The cross section for the recombination, if calculated from Simonenko's data, is equal to 10^{-8} cm²; as is known, its real value is of the order of 10^{-15} to 10^{-20} cm². Simonenko's curve for the density of the residual ion current, as a function of the electron-current density, does not point to a neutralization but rather to a displacement of the ion beam by the field of the electron beam.

4261

NP-1857(sect.9)

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
SYNCHROTRON GROUP, sect. 9 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. Bruno Rossi, W. L. Kraushaar, and J. S. Clark. Jan. 1, 1951. 1p. (NP-1857(sect.9))

Modifications in the synchrotron, in particular the placement of folded metal strips along each edge of the cavity gap, are described very briefly.

RADIATION ABSORPTION AND SCATTERING

4262

Los Alamos Scientific Lab.
CALCULATION OF PERMISSIBLE QUANTITIES OF VARIOUS MATERIALS IN BeO TAMPER. R. F. Schreiber. [nd] Decl. Apr. 24, 1951. 1p. (AECD-3148; LADC-916)

Data assembled in tabular form are intended to serve as a rough guide in the construction of the BeO stack. It indicates the materials which are quite harmless and so may be suitable for binder materials and also points out the materials whose high absorption makes them very undesirable even as small impurities. (auth)

4263

Radiation Lab., Univ. of California
ELASTIC SCATTERING OF 31.8-MEV PROTONS FROM HELIUM. (abstract) Bruce Cork. May 2, 1951. 1p. (UCRL-1264)

The report is reproduced here in its entirety.

Measurements have been made of the elastic scattering of 31.8-Mev protons from He at 1 atm. The large solid angle geometry used for proton-proton scattering (Cork, Johnston and Richman, Phys. Rev. 79, 71-80(1950)) was used to detect the forward scattered protons. Six different increments of angle have been observed, from 17 to 62° in the center of mass system. A plot of the differential cross section and a comparison with Rutherford scattering will be given. It is planned to detect the forward scattered α particles and thus obtain a more complete measurement of the differential cross section.

4264

COHERENT SCATTERING AMPLITUDES AS DETERMINED BY NEUTRON DIFFRACTION. C. G. Shull and E. O. Wollan. Phys. Rev. 81, 527-35(1951) Feb. 15.

The coherent-scattering properties of nearly 60 elements or nuclides for slow neutrons have been determined by neutron-diffraction techniques and are summarized in this paper. The phase of scattering and values for the coherent-scattering amplitude and cross section and for the total-scattering cross section are given. Pronounced differences in isotopic scattering properties have been found, and many nuclides are shown to possess strong spin-dependent scattering properties. Illustrations of thermal diffuse scattering and nuclear-spin incoherent scattering are given. (auth)

4265

DIRECTIONAL DISTRIBUTION OF 1040-KEV RADIATION FROM A HIGH VOLTAGE X-RAY TUBE. N. Goldstein, U. Fano, and H. O. Wyckoff. J. Applied Phys. 22, 417-18 (1951) Apr.

The distribution of the 1040-kev x rays emitted in various directions by a high-voltage x-ray tube has been measured by means of an indium resonance detector. All the directional intensity distributions are peaked in the direction of the incident electron beam, as should be expected, since the x rays take up much of the momentum of the irradiating electrons. However, the distributions are much less peaked for the higher-voltage runs than for the lower-voltage runs. The main contribution to this greater angular spread arises from the ability of higher-energy electrons to undergo a large deflection before their energy falls below the level required to activate the In detector. The data obtained with an additional Cu layer between the x-ray source and the detector do not indicate that the layer causes a clear and significant change of angular distribution within the low accuracy of the experiment.

4266

EFFECT OF FINITE NUCLEAR SIZE ON THE ELASTIC SCATTERING OF ELECTRONS. Louis K. Acheson, Jr. Phys. Rev. 82, 488-94(1951) May 15.

The effect of the finite size of the nucleus on the elastic scattering of electrons with energies in the neighborhood of 20 Mev has been calculated for two simple spherical nuclear models: a uniform charge distribution, and a uniform shell charge distribution, both of radius $R = 1.45 \times 10^{-13} A^{1/3}$ cm. An exact phase-shift analysis has been made, the phase shifts differing appreciably from those for a point nucleus only in the $j = 1/2$ state. Phase shifts for elements of Z = 13, 29, 50, and 79 have been plotted as a function of energy over the interval from 15 to 35 Mev, permitting the calculation of any desired cross section within this range. Representative curves of the ratio of the scattering cross section for the finite nucleus to that for a point nucleus have been plotted. The difference in the scattering due to the two models is large enough so that accurate experiments might distinguish between them, the actual average nuclear charge distribution probably falling somewhere between these two cases. The ability to differentiate between the two models, however, depends on the accuracy with which nuclear radii are known. (auth)

4267

MULTIPLE SCATTERING OF ELECTRON PAIRS FROM (Li,p) GAMMA-RAYS IN PHOTOGRAPHIC EMULSIONS. L. Voyvodic and E. Pickup. Phys. Rev. 81, 471-2(1951) Feb. 1. (Letter to the editor)

Scattering measurements have been made on electron pairs observed in emulsions exposed to Be^8 γ rays obtained by the bombardment of an evaporated Li target with a 450-kev resolved proton beam. Observations were made on 100 electron pairs at intervals of 20 divisions (1 div = 0.88 μ) for about 700 μ along each track.

4268

ON THE INNER PARITY OF THE POSITRON. V. B. Berestetskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 21, 93-4(1951) Jan. (Letter to the editor; in Russian)

The inner parities of the electron and the positron are opposite; this is a symmetric opposition, not a difference in sign. This situation must find its reflection in the phenomena of pair formation and annihilation.

4269

ON THE IONIZATION YIELDS OF HEAVY PARTICLES. Julian K. Knipp and Rufus C. Ling. Phys. Rev. 82, 30-5 (1951) Apr. 1.

Since the energy loss of a slow heavy particle is due predominantly to recoiling atoms, ionization by secondary heavy particles contributes a large fraction of the total ionization resulting from a slow heavy particle that is stopped in a gas. If the secondary heavy-particle ionization efficiency is low, the over-all efficiency for the production of ion pairs is greatly reduced for low energies of the primary particle. The secondary heavy-particle ionization efficiency satisfies an integro-differential equation in which the ratio of electronic to atomic stopping cross sections plays a critical role. Data by Madsen (Kgl. Danske Videnskab. Selskab, Mat. fys. Medd. 23, No. 8(1945)) on the ionization by recoiling particles in α decay are used to set limits on the ionization by slow argon particles in argon, from which it is possible to make crude estimates of the energy of fission fragments which fails to give rise to ionization at the usual rate. In argon, ionization defects of the order of several Mev are to be expected.

4270

THE RANGE-ENERGY RELATION FOR SLOW ALPHA-PARTICLES IN AIR. Joan M. Freeman and W. E. Burcham. Phil. Mag. (7) 42, 434-7(1951) Apr.

Range measurements made during work on (p,α) reactions by the authors in 1949 are used to check the new range-energy relation given by Bethe (Revs. Modern Phys. 22, 213(1950)). The $F^{19}(p,\alpha)$ reaction with E_p = 873.5 kev and angle of observation 83° was chosen as the standard. Results confirm the slope of the new range-energy curves over the energy range 1.0 to 2.3 Mev.

4271

SCATTERING OF SLOW NEUTRONS IN CRYSTALS; trans. from Zhur. Eksptl'. i Teoret. Fiz. 17, 770(1947). A. Akhieser and J. Pomeranchuk. 1947. 26p. (NP-2275)

The relation between slowing down of neutrons in crystals with identical and nonidentical nuclei has been considered. A general formula for the inelastic scattering cross section of neutrons in crystals with nonidentical nuclei is derived. The transition from scattering by bound to scattering by free nuclei with increasing neutron energy is clarified. Formulas are also derived for elastic and inelastic scattering of neutrons in crystals with identical nuclei.

RADIOACTIVITY

4272

Los Alamos Scientific Lab.
HALF-LIFE OF POLONIUM. William H. Beamer and William E. Easton. Sept. 9, 1946. Decl. May 22, 1951. 13p. (AECD-3156; LADC-923)

The half life of Po has been measured by a calorimetric method using large samples. Of the two samples studied, one was 14.35 c, and the other 10.93 c at the start of the decay curve. A value of 138.3 ± 0.1% days was found for the half life of Po. Results of several earlier investigations are discussed. 11 references.

4273

Purdue Univ.
THE DUAL DECAY OF Re^{186}. Rolf M. Steffen. [nd] 18p. (AECU-1324)

The decay of Re^{186} (91-hr) has been investigated using spectrometer and coincidence methods. Two β-ray groups with maximum energies of 1.070 ± 0.005 and 0.942 ± 0.008 Mev have been observed. The lower-energy β spectrum leads to an excited state in Os^{186} of 0.136-Mev energy. Nine per cent of all disintegrations are by K-capture, two-thirds of which lead directly to the ground state of W^{186} and one-third to an excited state of 0.122-Mev energy. Evidence is given for a spin 1 and odd parity of the ground state of Re^{186}. These assignments agree with the predictions of the one-particle spin-orbit coupling model extended to odd-odd nuclei. 8 figures.

4274

Aircraft Nuclear Propulsion Project
HARD GAMMA EMITTERS AMONG FISSION FRAGMENTS. William Krasny Ergen. May 3, 1951. 25p. (ANP-59)

The photoneutrons ejected from deuterium and Be by the fission fragment decay γ's which come from neutron irradiated U^{235} have been measured by a number of authors. The decay curves of the photoneutron activity were analyzed into empirical half lives under the assumption that the hard γ emitters were primary fission fragments. The resulting half lives did not correspond to the half lives of known fragments. An attempt has been made to represent the measured photoneutron decay curves by a superposition of decay curves of individual fission fragments which are known to emit γ's above the photoneutron threshold. Fission fragments with half lives longer than about 3 hr and with known γ's above the Be (γ,n) threshold in their own or in their daughters' spectrum have been listed. In D and Be these γ's may cause photoneutron activities, and the superposition of these activities fits the measured photoneutron activities caused by neutron irradiated U^{235} in D and Be. The fit is good to about 5% at waiting times greater than about 10 hr.

4275

Columbia Univ.
THE BETA-SPECTRUM OF Tc^{99}. (abstract) C. S. Wu and L. Feldman. [nd] 1p. (CUD-84; DR-1618)

The report is reproduced here in its entirety.

Tc^{99}, a product of U fission, has an unusually long half life of 10^5 to 10^6 yr. Its comparative half life, $fT \sim 10^{12}$ sec, leads to an empirical classification of second forbidden. Tc^{99} (1.7 μC/mg) was recently procured from the Isotope Division of the AEC, and its β spectrum was investigated with the solenoidal spectrometer. Several sources were prepared with varying thicknesses from about 0.1 to 0.4 mg/cm^2 on thin film backings of ~0.020 mg/cm^2. Although a detergent or insulin was used in all cases, the uniformity of the sources is not as good as desired. Repeated chemical purification and electroplating were both used to ensure purity. The uncorrected Kurie plot is markedly different from a linear allowed shape but is continuously curved concave toward the energy axis. When the Kurie plot is corrected by the unique correction factor for a $\Delta I = 3$(no) transition, $D_3 = \frac{1}{30}(p^4 + \frac{10}{3}p^2q^2 + q^4)$, it yields a curve with considerable curvature. Therefore, the D_3 factor can be excluded. However, $\alpha = \frac{1}{12}(p^2 + q^2)$, the unique correction factor for a $\Delta I = 2$(yes) transition, does give a straight line from the upper energy end down to about 120 kev. The extrapolated end point thus obtained is $W_0 = 2.93 \pm 5$ kev. The correction factor α occurs also in the second forbidden transitions C_{2T} and C_{2V} for $\Delta I = 2$(no). A theoretical interpretation with the predictions of the nuclear shell structure model will be presented.

4276

Columbia Univ.
INVESTIGATION OF THE COMPLEX β-SPECTRUM BY THE COINCIDENCE SPECTROMETER. (abstract) P. A. Macklin, L. J. Lidofsky, and C. S. Wu. [nd] 1p. (CUD-86; DR-1620)

The report is reproduced here in its entirety.

A coincidence technique in conjunction with Columbia's solenoidal spectrometer has been developed to resolve and investigate the β spectrum of the low-energy group from a complex spectrum. An anthracene crystal counter is used as the γ-ray detector and a G-M counter as the β detector. The resolution of the spectrometer is set at 10%. The Au^{198} β spectrum (a simple spectrum followed by γ emission) was investigated with and without coincidences to check the performance of the system. Complete investigation of the complex spectrum of Rb^{86} and Sb^{122} were completed. All sources were prepared by the vacuum evaporation method. Several different runs on Rb^{86} all gave an α-type spectrum for the high-energy group (1760 ± 10 kev) and a spectrum indistinguishable from the allowed shape for the low-energy group (670 ± 5 kev). The spectrum of the low-energy group could also be fitted by C_{1T} or C_{1V}. This is in good agreement with the results of Muther and Ridgeway (Phys. Rev. 80, 750(1950)). The uncorrected Kurie plot of the low-energy group of Sb^{122} also gives a straight line as in the case of Rb^{86}. The extrapolated upper energy limit of this group is 1460 ± 10 kev. The theoretical interpretation and its implication with the β-γ-angular correlation results will be discussed.

4277

Vanderbilt Univ. and Mississippi State Coll.
THE L TO K CAPTURE RATIO AND DISINTEGRATION ENERGY OF Sn^{113}. D. A. Thomas, S. K. Haynes, C. D. Broyles, and H. C. Thomas. Apr. 1951. 5p. (ORO-30)

In order to study the possibility of direct transitions of Sn^{113} to the 390-kev state and to the ground state, the following measurements have been made: With a counter of known β- and γ-ray sensitivity, α for the 390-kev transition was found to be 0.35 ± 0.1. The 85-kev γ ray, if present, was found to have an intensity of less than 1% of the 390-kev. With a low-energy compensated magnetic lens spectrometer, a very thin electroplated source, and two thin nylon windows (36 and 18 μg/cm^2) the intensity of the K Auger electrons relative to the total conversion electrons of the 390-kev transition was found to be 0.61 ± 0.01. The most probable ratio of L capture to K capture has been determined as 0.81 with extreme values of 0.31 and 1.43. It is concluded that the spin value of Sn^{113} is ½ or ½. The proposed decay scheme is shown. 12 references.

4278

National Inst. of Health
CORRECTION TABLES FOR RADIOACTIVE DECAY. Barbara S. Smith. [nd] 24p. (NP-3096)

Tables of decay correction factors for various biologically important radioactive isotopes are presented to 4-place accuracy based on half-life estimates in current acceptance. Copies of these tables may be obtained by letter of request to the National Institutes of Health, Attention: Scientific Reports Branch, Bethesda 14, Maryland.

4279

ENERGY OF BETA PARTICLES AND PHOTONS FROM Ca^{45}, Zn^{65}, and CO^{60} BY ABSORPTION. Lennart Simons.

Soc. Sci. Fennica Commentationes Phys. Math. 15, No. 9, 1-11(1950) Mar.

The range and maximum energy of β radiation from Ca^{45}, Zn^{65}, and Co^{60} have been determined by absorption in Al. In addition the half thickness and energy of γ radiation from Zn^{65} have been determined. A hypothesis by which the energy spectrum of β radiation can be approximated from absorption measurements is presented. A comparison between the results obtained from absorption and β-spectrographic measurements shows that even for maximum ranges of approximately 0.2 Mev the spectra agree at the maximum end. As a trial an energy spectrum on the basis of the β absorption has been constructed for Ca^{45}. The fact that the Fermi curve ends in a nearly straight line confirms in a way the correctness of the spectrum. In addition the Fermi diagram gives a maximum energy in agreement with the one obtained according to Feather analysis.

4280

THE NEW NEGATIVE PARTICLES OF HIGH MOMENTUM IN THE SPECTRA OF β-RADIOACTIVE ELEMENTS. Jean Thibaud. Compt. rend. 232, 398-400(1951) Jan. 29. (In French)

Experiments in which various thicknesses of Al, Ni, Zn, Pd, Ta, etc., were placed in the path of the high-momentum particles in the β spectrograph are reported briefly. The results are consistent with the hypothesis that β decay is the emission of negative particles, most of which decay to electrons in the vicinity of the disintegrating nucleus; the continuous β spectrum observed being, therefore, a secondary phenomenon. The mass of this new particle has not yet been estimated, in part because of the difficulty in distinguishing its tracks in emulsion from those of electrons.

4281

RADIOACTIVITY OF NICKEL. H. W. Wilson. Phys. Rev. 82, 548(1951) May 15. (Letter to the editor)

The proportional-counter technique has been used in a further search (H. W. Wilson, Phys. Rev. 79, 1032(1950)) for low-energy γ rays of Ni^{59}. Results seem to confirm the author's earlier conclusion that Ni^{59} decays by a simple K-capture process and imply that the 3 additional γ rays reported by Thomas and Kurbatov (Phys. Rev. 77, 151(1950)) arise from the decay of some element other than Ni. The half lives of Ni^{59} and Ni^{63} have been recalculated as 7.5×10^5 yr and 61 yr, respectively.

THEORETICAL PHYSICS

4282

Oak Ridge National Lab.
THE STATUS OF QUANTUM FIELD THEORY. S. M. Dancoff. Aug. 1949. 70p. (AECU-1099)

The status of various quantum-mechanical field theories is outlined in a series of talks on such subjects as the self energy and subtraction techniques with regard to quantum electrodynamics; nature of a physical theory; meson theory of nuclear forces; and π and μ mesons.

4283

A GENERALIZATION OF THE METHOD OF LENNARD-JONES AND DEVONSHIRE FOR THE CALCULATION OF THE CONFIGURATION INTEGRAL. (FIRST COMMUNICATION.) P. Janssens and I. Prigogine. Physica 16, 895-906(1950) Dec. (In French)

A cell method for the evaluation of the configurational free energy is presented in which each cell can contain 0, 1, or 2 particles. This method, which is a generalization of the method used by Lennard-Jones and Devonshire (Proc. Roy. Soc. 163A, 53(1937); ibid. 165A, 1(1938)), gives a correct evaluation of the so-called "communal" entropy of the system. Numerical computations based on simple laws of force indicate that the value of the critical volume so calculated is in much better agreement with the experimental value than the value given by the Lennard-Jones and Devonshire method. (auth)

4284

HYDROGEN-LIKE ATOM IN QUANTIZED SPACE. (NON-RELATIVISTIC THEORY). P. Kard. Zhur. Eksptl'. i Teoret. Fiz. 20, 1144-5(1950) Dec. (Letter to the editor; in Russian)

An attempt is made to calculate, nonrelativistically, the energy levels of a hydrogen-like atom in a quantized space by using a modified Schroedinger's integral equation in the space of momenta; the modification is made in order to introduce the elementary length.

4285

ON THE THEORY OF ANGULAR CORRELATION PHENOMENA. Leonard Eisenbud. J. Franklin Inst. 251, 231-46(1951) Feb.

The correlation distribution function for emissions of nonrelativistic particles in two successive disintegrations of a system is calculated without the use of perturbation theory and without particular assumptions for the nature of the "interactions" responsible for the transitions. The calculation is limited to transitions with the emission of only one particle (or more precisely, the disintegration of a quasi stationary system into two subsystems). Some general properties of correlation distribution functions are obtained. Also the number of undetermined parameters which enter the distribution function is counted under important restricting conditions. The form of the calculation makes possible the exhibition of the formal identity of the correlation distribution function with the angular distribution function for resonance reactions. Both distribution functions may be represented as polynomials in $\cos^2 \theta$ of degree not greater than J, where J is the spin of the intermediate states of the two processes. (auth)

4286

ON THE THEORY OF INTERACTION OF A PARTICLE WITH A QUANTIZED FIELD. S. V. Tyablikov. Zhur. Eksptl'. i Teoret. Fiz. 21, 16-24(1951) Jan. (In Russian)

Several problems of interaction of a single particle with a quantized field are examined assuming weak interactions. Instead of using the perturbation theory, as is customary

in this kind of problem, the author employs a method of successive diagonalizing in which the separation of the variables of the particle and of the field is obtained with the aid of canonical transformations. As a result of the interaction between the particle and the field two quantities appear, viz., an effective mass of the particle and an additional uncertainty in the coordinate. Owing to the interaction with the field of real "photons," both quantities depend on the temperature. As examples, the interactions of the particle with the scalar and the electromagnetic fields are discussed. (auth)

4287

PROPERTIES OF DIRAC WAVE FUNCTIONS IN A CENTRAL FIELD. M. E. Rose and R. R. Newton. Phys. Rev. 82, 470-7(1951) May 15.

The boundary conditions for a Dirac particle in a central scalar field are discussed for both bound and continuum states. In this development, the methods employed are considerably different from those customarily used for the corresponding nonrelativistic case. (auth)

4288

RADIATIVE PROCESSES IN THE PRESENCE OF HEAVY NUCLEI. G. Parzen. Phys. Rev. 81, 808-14(1951) Mar. 1.

Calculations of the cross sections for bremsstrahlung and pair production are carried out without the use of the Born approximation, but by reducing the calculation of these cross sections to the calculation of the exact elastic scattering of electrons and positrons, the last quantities having been tabulated to some extent. Large deviations from the Born-approximation results are obtained in the angular distributions of these radiative processes, but arguments are presented that the Born approximation should yield the integrated cross sections correctly at sufficiently high energies. The failure of the Born approximations for relativistic equations is explained in a purely classical way. (auth)

4289

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
THEORETICAL GROUP, sect. 10 of PROGRESS REPORT [NINETEENTH, FOR FOURTH QUARTER OF 1950]. H. Feshbach. Jan. 1, 1951. 3p. (NP-1857(sect.10))

Brief statements are presented of progress on calculations of photomeson production on deuterons, covariant two-body problem for spin-zero state, production of neutral mesons in nuclear electric fields and the mean life of the neutral meson, angular distribution of mesons produced in proton-proton collisions, electronuclear scattering, inelastic scattering of neutrons, and nuclear reaction theory.

4290

WAVE EQUATION OF THE ELECTRON. C. Jayaratnam Eljezer. Nature 167, 78-9(1951) Jan. 13. (Letter to the editor)

For high-frequency fields there are indications that the Dirac wave equation of an electron is only approximate and that allowance should be made for the finite size of the electron. An equation is suggested which differs from the Dirac equation by the addition of an infinite series representing the additional contributions to the Hamiltonian from the multipole interactions of the particle with the electromagnetic field. The author states that such an equation would describe an electron which is a superposition of a point charge, a point dipole, and point multipoles to all orders, and it might be expected to describe a finite electron. The additional terms are negligible when the field varies slowly, but will be important for fields of high frequency.

PATENTS

CHEMISTRY

4291

PREPARATION OF DIBORANE. H. I. Schlesinger and H. C. Brown (to U. S. Atomic Energy Commission). U. S. Patent No. 2,555,512, June 5, 1951.

A process is described for purifying diborane contaminated with hydrogen halides which comprises contacting the impure mixture with an amine such as trialkylamine or pyridine which will form nonvolatile addition compounds with the contaminating halide.

ENGINEERING

4292

CABLE TESTING SYSTEMS AND METHODS. J. D. Gow (to U. S. Atomic Energy Commission). U. S. Patent No. 2,558,485, June 26, 1951.

This testing device is adapted to measure and indicate the position of an inner conductor of a coaxial cable with respect to the cable sheath; a feeding mechanism automatically feeds the cable through the device, and the device may be affixed to the cable at any desired position.

4293

ELECTROMAGNETIC PUMPS. E. J. Wade (to U. S. Atomic Energy Commission). U. S. Patent No. 2,558,698, June 26, 1951.

An electromagnetic liquid-metal pump of increased efficiency is described which uses a series of insulating barrier vanes inside the liquid-metal conduit to reduce the tendency of the electric current to diverge in passing through the liquid metal.

4294

PNEUMATIC AND AIR SWEEP CLOSURE. O. C. Sperling (to U. S. Atomic Energy Commission). U. S. Patent No. 2,559,564, July 3, 1951.

A pneumatic closure is described for effectively sealing the ends of a hollow test specimen undergoing leak detection so that in-leakage from the atmosphere surrounding the test specimen must necessarily be caused by faults in the specimen and not by leaks in the seal.

4295

VALVE. R. B. Pontius (to U. S. Atomic Energy Commission). U. S. Patent No. 2,555,996, June 5, 1951.

This needle-type valve is particularly useful for controlling the flow of corrosive gases. This valve has a control chamber of variable size with a flexible wall encompassing the flow control elements so that a minimum number of moving parts are exposed to the corrosive gases.

MINERALOGY, METALLURGY, AND CERAMICS

4296

CASTING METHOD AND COMPOSITIONS. J. S. Church and H. R. Tyler (to U. S. Atomic Energy Commission). U. S. Patent No. 2,559,345, July 3, 1951.

Polymerizable methyl methacrylate compositions are cast by effecting a solution of the polymeric material in the monomer by the use of a mutual solvent for the two, which has a b.p. below that of the monomer, then removing the solvent by low-pressure low-temperature distillation and casting the resultant solution at a temperature not in excess of 50°C.

4297

GOLD AND BERYLLIUM ALLOY AND METHOD OF MAKING SAME. H. Hirsch and M. Kowalchik (to U. S. Atomic Energy Commission). U. S. Patent No. 2,556,921, June 12, 1951.

An alloy of Au and Be is prepared by mixing about 8% Be powder with about 92% Au powder, compacting, heating, and compressing.

4298

THE PREPARATION OF COMPACTS OF HIGH-DENSITY URANIUM HYDRIDE. M. L. Perlman and S. I. Weissman (to U. S. Atomic Energy Commission). U. S. Patent No. 2,558,377, June 26, 1951.

A method is described for preparing high-density uranium hydride compacts which comprises treating uranium metal, which is in the form of a plurality of pieces, with hydrogen at about 200°C and confining the resultant hydride to the original volume of the metal to cause high compacting pressures to be generated.

PHYSICS

4299

FLUX PHASE INDICATORS. W. M. Powell (to U. S. Atomic Energy Commission). U. S. Patent No. 2,557,761, June 19, 1951.

A device is described which will graphically depict the magnetic flux phase difference between points in a varying magnetic field.

4300

METHOD OF MAKING A SOURCE OF BETA RAYS. J. R. Raper (to U. S. Atomic Energy Commission). U. S. Patent No. 2,559,259, July 3, 1951.

A source of pure β emissions is prepared by incorporating a potential β emitter such as red phosphorus into a suitable plastic, forming into a desired shape, and thereafter subjecting to neutron irradiation.

4301

METHOD FOR MEASURING RADIATION OF NEUTRONS. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent No. 2,558,919, July 3, 1951.

A neutron density measuring device is described which utilizes a composite member which fluoresces or phosphoresces when subjected to neutron irradiation. The composite member is made by superposing a layer of a fluorescent or phosphorescent material upon a layer of material which fissions when subjected to neutron irradiation.

4302

NEUTRON DETECTOR. J. L. McKibben (to U. S. Atomic Energy Commission). U. S. Patent No. 2,556,768, June 12, 1951.

A neutron detector is described which has a substantially uniform sensitivity to neutrons between energies of a few kilovolts and a few million volts. The device uses a neutron responsive unit which is inherently responsive only to neutrons of a particular limited energy range with a neutron reflector structure which effectively extends the response range of the neutron-responsive unit.

4303

PULSE ANALYZER. W. E. Glenn, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,560,166, July 10, 1951.

A pulse analyzer is described which employs a modified cathode-ray-type tube for counting pulses of voltage of short amplitude over a large range of amplitudes.

4304

PULSE SHAPING CIRCUIT. W. E. Glenn, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,560,167, July 10, 1951.

The pulse-shaping circuit described comprises a pulse sharpener, an amplifier, a pulse-flattening circuit, and a cathode-follower output circuit.

4305

PULSE WIDTH MODULATION. R. J. Watts (to U. S. Atomic Energy Commission). U. S. Patent No. 2,556,457, June 12, 1951.

A simple pulse-width modulation circuit is described wherein a rapid transmission of intelligence with high signal-to-noise ratio is obtainable.